MARCH 20, 1922

AVIATION

VOL. XII. NO. 12

Member of the Audit Bureau of Circulations

CONTENTS

Editorials	335	Improvements in Aircraft Power Plants	345
The Past Year in Naval Aeronautics	336	French Air Budget	346
The Battle Cruiser-Aircraft Carriers	338	"Who's Who in American Aeronautics"	347
British Safety Tank Competition	338	Preparing Altitude Records	348
Explanation of the Roma Picture	339	Merger of French Air Lines	348
Speed Trials of Airships	339	Naval Aviation News	349
Future Development of Fighting Airplanes	340	Huff-Daland in Kansas City	349
French Air Transport Economics	343	A. S. Instruction Course	349
A. S. Air Intermediate Depot	343	Schoen Field	349
Aviation and the Law	344	Coming Aeronautical Events	349
A. and D. R. Black	344	Aeronautical Briefs	350

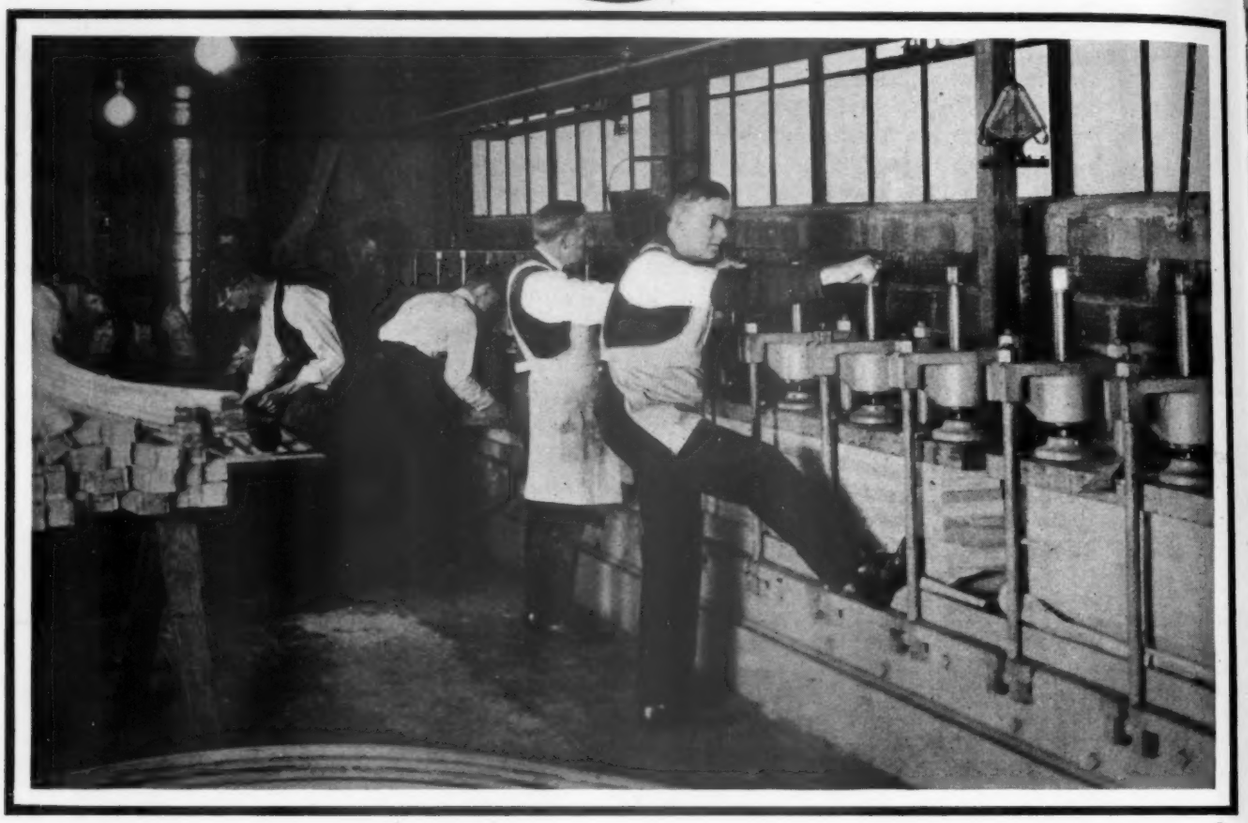
THE GARDNER, MOFFAT COMPANY, Inc., *Publishers*
HIGHLAND, N. Y.
225 FOURTH AVENUE, NEW YORK

Subscription price: Four dollars per year. Single copies fifteen cents. Canada, five dollars. Foreign, six dollars a year. *Copyright 1922, by the Gardner, Moffat Company, Inc.*

Issued every Monday. Forms close ten days previously. Entered as second-class matter Nov. 22, 1920, at the Post Office at Highland, N. Y., under act of March 3, 1879.

THOMAS-MORSE AIRCRAFT CORPORATION

THOMAS-MORSE AIRCRAFT CORPORATION



Going to Press

The photograph here shows a battery of the special glue presses for joining laminated wood parts. This careful lamination produces a unit infinitely stronger and more enduring than could possibly be shaped from a single piece of wood, while still preserving the important lightness and resiliency which are inherent to wood.

The process calls for the most careful work, the best of materials, and ideal conditions in respect to temperature and humidity of the glue room. Science and experience must be combined to secure an unfailing joint of maximum strength.

It is only one detail in the making of a Glenn L. Martin airplane; but it illustrates again the forethought, experience, and care which have placed the Glenn L. Martin planes in a position second to none in America.

THE GLENN L. MARTIN COMPANY

CLEVELAND

Member of the Manufacturers Aircraft Association

L. D. GARDNER, PRESIDENT
W. D. MOFFAT, VICE-PRESIDENT
W. I. SEAMAN, TREASURER
GEORGE NEWBOLD, BUSINESS MANAGER

AVIATION

LADISLAS D'ORCY, EDITOR
VIRGINIUS E. CLARK
EDWARD P. WARNER
RALPH H. UPSON, CONTRIBUTING EDITORS

Vol. XII MARCH 20, 1922 No. 12

Armored Fighting Airplanes

IN the paper on fighting airplanes read by Major Green before the Royal Aeronautical Society, which is reproduced in parts in this issue, the view is expressed that few fundamental changes will occur in this type of machine in the near future, say, within the next ten years. The lecturer is of the opinion that the principal improvements will consist in better performance and in an increased rate of fire for the guns, and that the specialized types for high altitude and low altitude work which were developed toward the end of the war will remain the main fighting craft of the air.

As Major Green says, it is very unsafe to predict the development of airplanes. However, it seems to us that the lecturer's views on the immediate development of the fighting or pursuit airplane are ultra-conservative, for they do not contemplate the possibility of a change in the strategy and tactics of air fighting.

What indeed is the present situation? Drawing on the naval simile, the pursuit airplane represents the capital ship of the air, if not in punishing power, then at least in its intent and function. That is, the pursuit airplane exists for the purpose of enabling one to establish aerial ascendancy, or mastery of the air, by sweeping the skies clear of enemy pursuit airplanes and, as a secondary result, of observation and bombing airplanes as well.

Now, the pursuit airplane derives its offensive power from gun power and maneuverability, and not from gun power and protection, as the capitalship. The protection in the case of the pursuit airplane is entirely a function of its maneuverability, for given two airplanes of equal gun power but unequal maneuverability, the advantage will lie with the more maneuverable ship, all other things being equal. But the reason this is so is due to the fact that our capitalships of the air are highly vulnerable to gunfire provided it is possible to hit them. The question then arises whether there should not be developed a type of armored pursuit airplane endowed with a good performance, maneuverability, *and* range, which will be invulnerable to gunfire, or almost so. If such a ship had a performance and range slightly superior to that of observation and bombardment airplanes, and be just capable of outmaneuvering the latter types, there would become available an airplane which would actually fill the function of a capitalship of the air. Such an armored single seater could tackle any kind of military airplane, for, given equal gun power, the superior performance and maneuverability of the ordinary pursuit machine would be of little avail against the armor-plated "battle-plane," for the latter's superior range would enable it to "keep the air" while the pursuit plane would be forced down by lack of fuel, if for no other reason.

The development of such an armored battle plane is well within the present engineering possibilities. As a type, the cantilever metal monoplane is suggested, for it would permit of working the armor plating into the structure of the machine and so make it contribute to its strength, while on the other hand the cantilever monoplane does away with all those exposed vital parts (struts, wires, etc.) which when damaged may cause the machine to collapse.

We are fully aware that there are some serious objections to the use in warfare of such a machine; we nevertheless believe that the question should be gone into in detail if for no other reason than the possibility of some other air force tackling the question.

Making Air Transport Pay

THE brief note on the economics of French air transport enterprises which appears in this issue will be read with interest by all those who for some time have wondered whether the French subsidization of air lines was building up, however slowly, a self-supporting business, or whether it merely constituted a hidden premium for a military air reserve and so defeated its avowed purpose of fostering air transport.

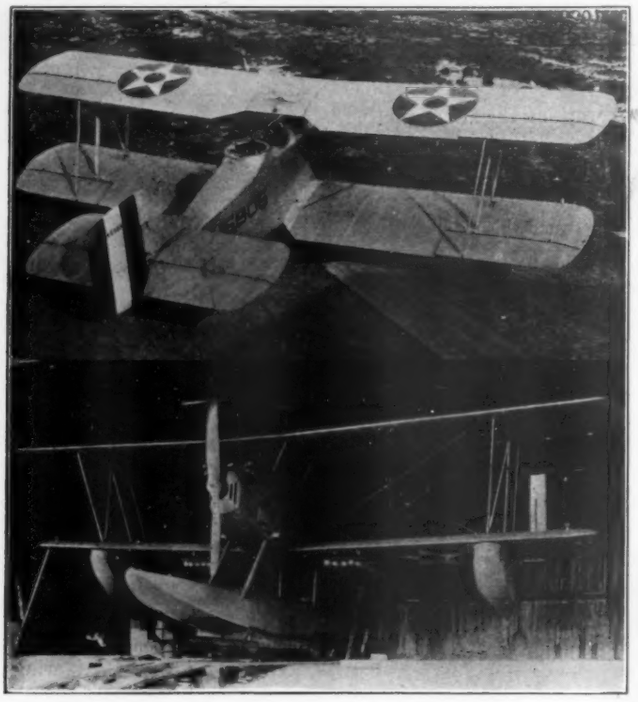
It is gratifying to learn that the misgivings voiced by the adversaries of subsidized air services are beginning to be disproved by actual facts. While it is true that up to last summer the French airways lost money on the passenger carrying business despite the government subsidy, in the six months which followed conditions improved to such an extent that the companies did not lose any money, and some of them made profits. Of course even this was contingent upon the subsidy, but the improvement is significant enough to warrant careful scrutiny.

The main point about the economics of French air transport is, in our opinion, that the French are endeavoring to build up the most difficult kind of air transport, that of passengers. Passengers, whether carried on land, by sea, or by air, form the most unremunerative of all transportable items, for the comfort passengers require, not to speak of safety appliances and the like, takes up an inordinate amount of valuable cargo space. Hence the commercial efficiency of passenger airplanes is, just like that of the palatial ocean liners and of the luxurious express trains, extremely poor, and their operation is correspondingly expensive. It is a fact that even the highest passenger rates charged by steamship lines do not "pay," but merely cover expenses, and it is from freight carrying that the steamship operators derive their profits, some of which are eaten up by the requirements of passenger transport.

These facts deserve to be carefully considered in planning commercial air services. They are incidentally in accordance with the views Mr. Cowie, president of the American Express Co., expresssed at the last Aeronautical Executives' Luncheon, when he said that the three "best bets" of air transport are, in the order named, express, mails, and passengers.

The Past Year in Naval Aeronautics

Bureau of Aeronautics -- Catapult Launching Gear -- Lakehurst Airship Shed -- Gallaudet "Multiple Drive" -- Aircraft Carriers



Elias EM1 expeditionary airplane: above fitted as a land machine, and below as a seaplane

A review of the year's aeronautical activities prepared by the Navy Department tells the following story of achievement:

Bureau of Aeronautics

The outstanding feature of the progress of Naval Aviation during the past year has been the formation of the Bureau of Aeronautics. The centralization of all branches of Naval Aviation heretofore scattered among the various Bureaus of the Navy Department under one head has greatly simplified all matters concerning design, development, construction, operation and issue of aircraft and of aviation material—and the detail and training of personnel for aviation duties. This has resulted in unity of effort with its consequent economy and the expedition of work. It has also given the Navy a central agency for the formulation and promulgation of Naval air policies and doctrines.

Following this unification of Naval Aeronautics, work has been undertaken or accelerated in many important aviation directions, among which the most essential are the following:

The Catapult Launching Gear

The redesign of the old catapult mechanism into a form suitable for simplified installation and use aboard battleships and cruisers. This new catapult has somewhat the physical characteristics of a twin torpedo tube, and enables airplanes whether land or sea planes to be launched from vessels without interfering with their maneuvers or gun operations. As actually installed on one battleship of the fleet it enables her to launch and make use of any number of planes she can find storage space for. Equipment is now being prepared for other battleships. This device installed on vessels engaged in the trans-Atlantic trade such as mail liners should expedite the delivery of overseas mail by at least twenty-four hours.

The practical completion of the Navy's first experimental airplane carrier, the Langley. This ship can be employed as a movable airdrome, thus permitting the use of airplanes with the fleet at any distance from shore. In this connection there has been conducted a series of experiments to develop arresting gear for carrier decks.

The production of helium to such an extent as to make possible the practical demonstration of the use of non-inflammable helium gas in an airship. (The inflation and flights of the airship C7, the first airship in the world to fly with helium gas support).

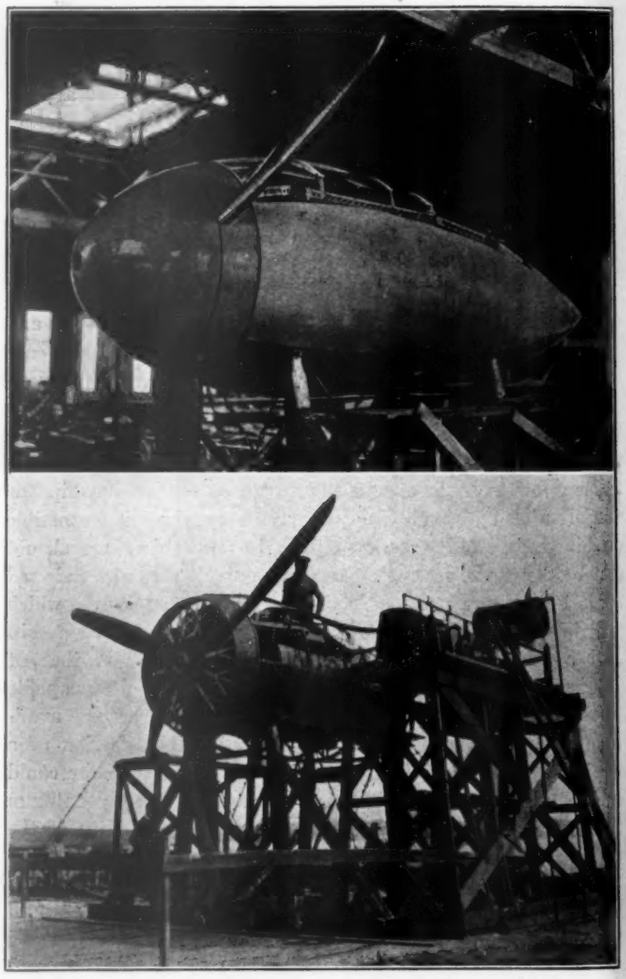
The completion of the largest airship hangar in the world at Lakehurst, N. J.

The adoption and construction of the mooring mast—a device from which airships can be moored in the open, avoiding the necessity of entering hangars except for repairs. Mooring masts are being constructed at Lakehurst, N. J., and Pensacola, Fla.

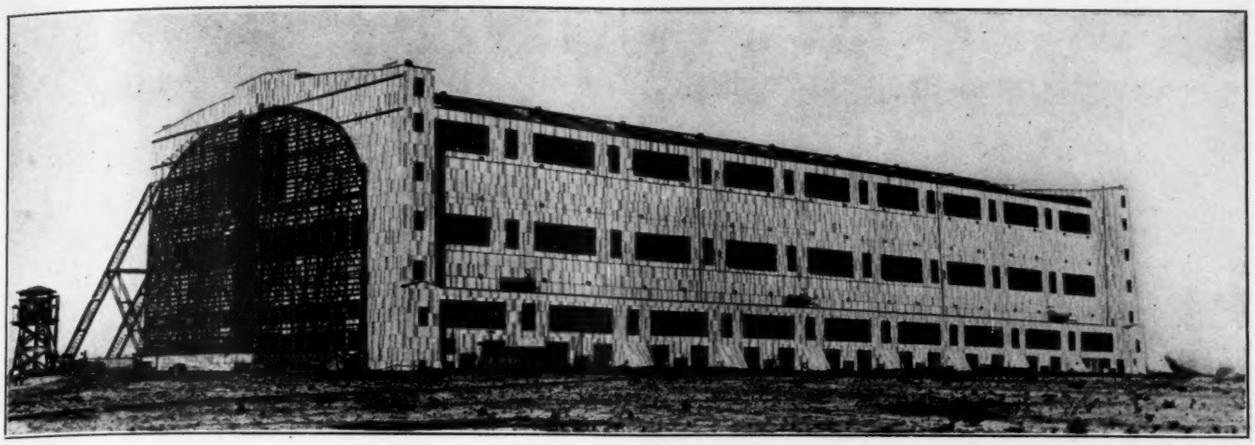
The Lakehurst Airship Shed

The completion of experimental problems involved in the construction of the rigid dirigible ZR1, and beginning construction of the ZR1 at the Naval Aircraft Factory, Philadelphia, Pa., and at Lakehurst, N. J.

The practical completion of arrangements for the acquisition



The Gallaudet "multiple drive" in which three Liberty's are geared to a single 18 ft. propeller



The great Hangar at the Lakehurst Naval Airship station— the largest of its kind in the world

by the Navy without cost to the United States of a rigid airship to be constructed in Germany.

The development of satisfactory combat planes for the fleet has been undertaken as a problem in connection with defense against aerial attack on the fleet. Several types of high performance combat planes are under development.

Types of torpedo planes have been developed in order to increase the offensive power against enemy fleets.

An amphibious flying boat has been built and successfully tested.

Ship planes for spotting gun fire to enable the fleets to use aviation for increasing its hitting power at long ranges. New types of this class of planes are under development.

The Gallaudet "Multiple Drive"

The Bureau of Aeronautics' policy of stimulating technical improvements in the art has resulted in making available three new aviation engines of superior characteristics, a variable pitch propeller, an 18 ft. propeller absorbing through gearing the power of three Liberty engines, making it the most powerful aircraft propeller in the world, perfection of reduction and reverse gearing for Liberty engines, detail improvements in the design of Liberty engines which permits higher compression and at the same time better economy and longer life.

The Pulitzer Race was won by a Navy plane, showing the world's speed record for a closed course.

The completion and commissioning of the U.S.S. Wright, our first properly equipped fleet tender for lighter and heavier-than-air craft.

Participation in the sinking of ex-German warships by aircraft bombs.

Flights of Naval Air Squadrons accompanying both the Atlantic and Pacific Fleets on cruises to southern waters including the Panama Canal.

Unaccompanied flight of two airplanes commanded by the Marine Corps from Washington, D. C., to Santo Domingo City, D. R., and return.

The completion of approximately two and one- half million miles flown by Naval Aircraft.

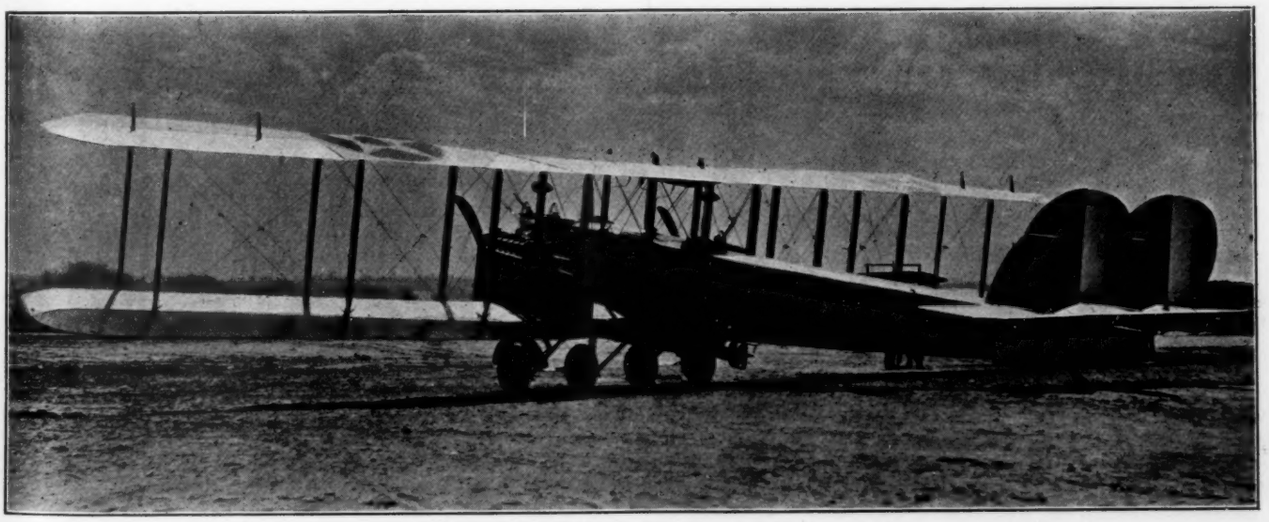
Aircraft Carriers

Designs have been completed by the Bureau of Engineering for the conversion of the Langley from a collier to an airplane carrier and for the conversion of the Wright from an Army transport into an airplane tender.

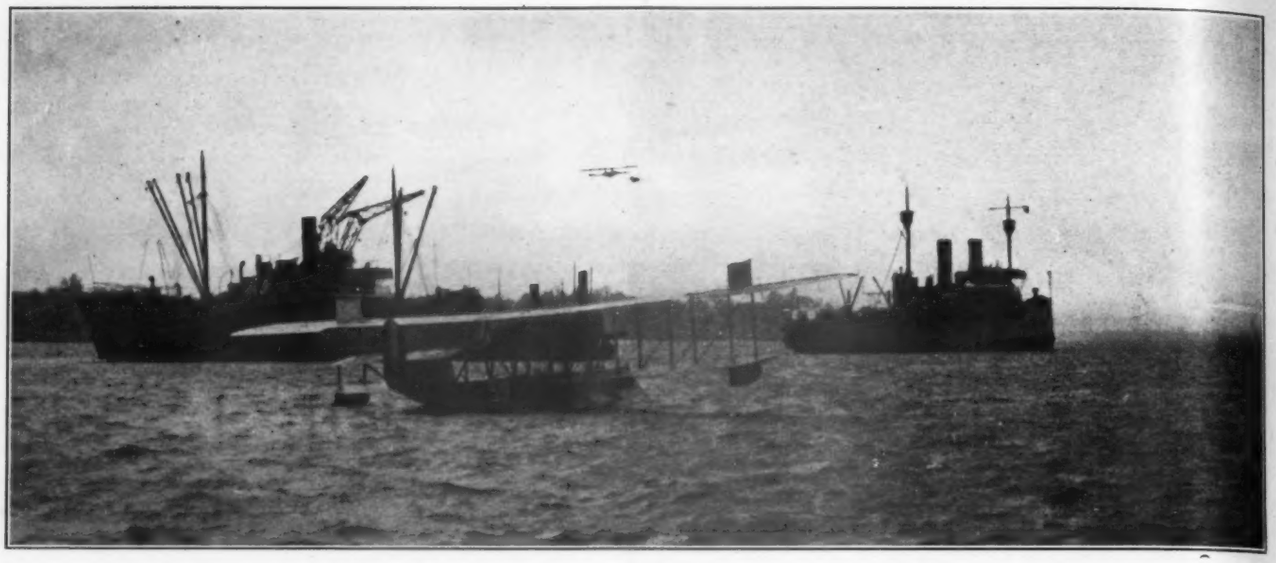
Plans have been completed for the conversion into aircraft carriers of two of the battle cruisers which are to be scrapped in accordance with the terms of the Armament Conference.

Bureau of Yards and Docks

In the matter of aviation facilities, the Bureau of Yards and Docks has concentrated its efforts on seven coastal stations maintained under permanent naval policy. Emergency stations have been closed, and their equipment, for the most part, disposed of. A complete new heavier-than-air station has been developed since May, 1921, in Hawaii. It comprises a large double-section hangar affording accommodation for numerous planes, shops, storehouses, quarters, a dispensary,



The Glenn Martin torpedoplane (2-400 hp. Liberty engines) which is equipped to carry a 1500-lb. regulation torpedo



U. S. naval aircraft afloat and aloft, with the aircraft tender Shawmut to the right. The seaplanes are of the F5L type

and all services necessary for efficient operation. This plant has involved an expenditure of $1,650,000, and is now nearing completion.

Many improvements have been carried out at the great lighter-than-air station at Lakehurst, N. J. A mooring mast, designed by the Bureau, has been erected by station forces. To this mast the largest dirigibles may be moored by the work of five or six men, whereas 300 or more hands are required for maneuvering the same ship into the hangar. As a temporary holding device, the mast is unexcelled. It allows the ship to pivot in the wind, and affords adequate protection even in rough weather.

At Lakehurst a hydrogen plant and complete power and service systems have also been lately installed.

The Battle Cruiser-Airplane Carriers

A bill authorizing the conversion of two battle cruisers into airplane carriers was introduced by Congressman Hicks of New York on Feb. 28 in the House and referred to the Committee on Naval affairs. The Bill (H.R. 10,647) designates no specific vessels for conversion, but a memorial of the legislature of Massachusetts, presented by Mr. Dallanger of Massachusetts, favored having the work of converting the Lexington, now under construction at Quincy, Mass., carried out. This was also referred to the Naval Committee.

The two vessels believed to have been selected are the Lexington, building at the Bethlehem Shipbuilding Corp.'s yard at Fore River, Mass., and the Saratoga, building at the New York Shipbuilding Corp. at Camden, N. J. These battle cruisers are the two farthest advanced in construction, the former being 33.2 per cent complete, and the latter 33.7 finished.

According to the terms of the naval treaty the Government may convert two battle cruisers to airplane carriers provided their displacement when converted does not exceed 33,000 tons each. The ships as designed were to be of 43,500 tons displacement, but with the elimination of their armor and ordnance their tonnage will fall within the prescribed tonnage, experts believe. Of the total tonnage for airplane carriers alloted to this country, the two ships will amount to 66,000 tons, leaving 49,640 tons to be built if the Langley which is about ready for commissioning is retained, and 69,000 tons if she is discarded. New carriers, except the two converted ships mentioned, cannot exceed 27,000 tons each.

Great Britain, it is said has seven carriers totaling 87,640 tons, listed as experimental ships they are the Hermes, Eagle, Argus, Furious, Pegasus, Ark Royal and Vindictive, but they may all be replaced with 33,000 ton vessels within the limit of 135,000 tons.

Japan has two airplane carriers, the Wakamiya, 5875 tons, and the Hosho, building, of 9500 tons. Japan under the treaty also has the privilege of converting two capital ships to carriers to be not over 33,000 tons each. Provided she converts these ships, she may still build one carrier of 15,000 tons.

British Safety Tank Competiton

A number of tanks entered into the safety tank competition organized by the British Air Ministry were recently tested at the Royal Aircraft Factory in Farnborough.

The Air Ministry offered prizes amounting to $10,000 for a tank which will not burst or leak and will be safe from penetration by bullets. Twenty-seven firms have entered, of which one is Italian, two French, one Japanese, one American and the rest British.

The rules of the competition provide that the tank shall weigh not more than 1¾ lb. per gal. Among the other qualities insisted upon are lightness, durability, indifference to extremes of temperature and simplicity of construction.

Imitation "crashes" are realistically staged in the tests. Each competing tank, incased in a rough wooden fuselage, is attached to a lump of concrete weighing 600 lb. to represent the engine. The whole contraption is hauled to the top of a large balloon shed, about 100 ft. high, then released and allowed to rush on wheels down a rail to smash into a bed of hard slate at the bottom. The tank descends at the rate of about 80 m.p.h. and reaches the bottom with a satisfactory thump.

Three kinds of shock-absorbing tanks have so far been tested. The first, manufactured by Beasley, Sims & Morris, consisted of three shells—an outer one of thin steel with a layer of rubber on the inside, then a steel shell with another layer of rubber, and, thirdly, the gasoline vessel itself, which is kept in position by shock-absorbing springs.

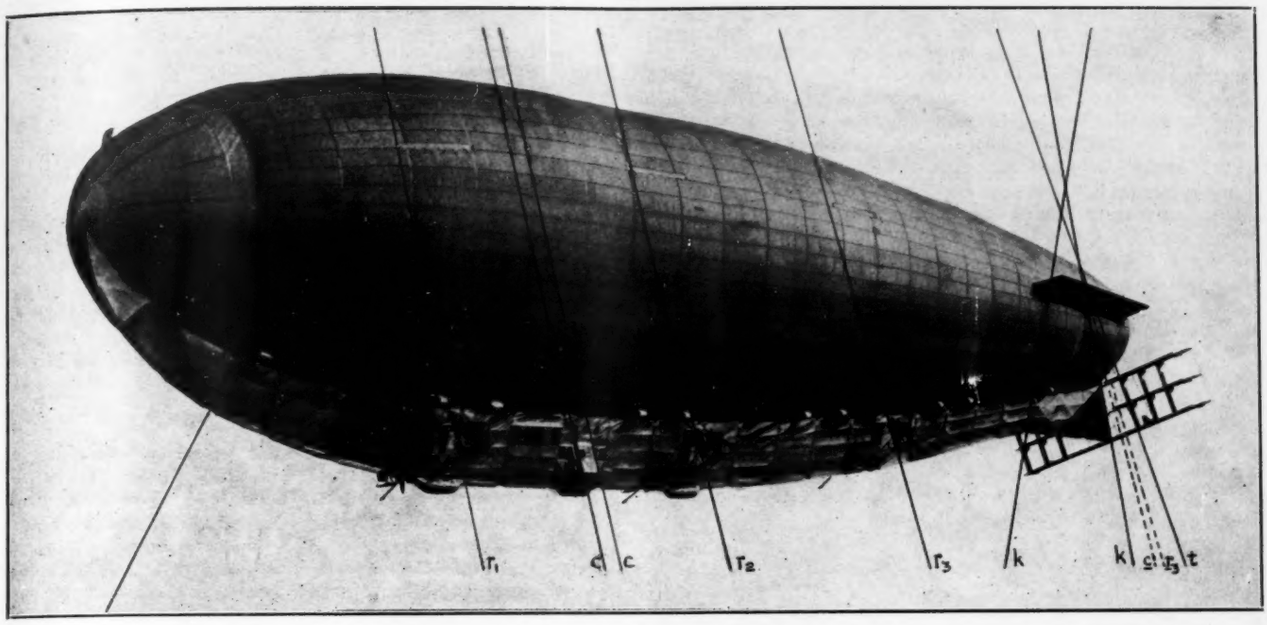
The second type, the invention of J. Gibson, is made on the bulkhead principle, the tank, shaped like a barrel, being made in three sections, the sections in front and behind the actual gasoline tank arranged to prevent damage to the gasoline tank itself.

The third tank sent in by the French firm of Bramson, is made of a rubber preparation with a sort of armoring of fine woven wire. This tank is mounted on rubber shock-absorbers, so that when it collides it bounces back like a ball.

No result will be reported until the tests are finished. Later the tanks will be fired upon by machine-guns at short range to test their capacity to remain gasoline-tight when penetrated by nickel or incendiary bullets.

Explanation of the Roma Picture

Which Shows that the Picture was not Taken the day of the Last Flight, and that the Elevator-Rudder was not out of Alignment



The picture of the Roma which was published in our issue of March 6, with reference lines superimposed, showing that the tail was not out of alignment

Lest any doubt remain regarding the picture of the Roma which was published on p. 281 of the March 6, last, issue of AVIATION, the following explanation is offered in connection with the accompanying illustration which is identical with that originally published, save for the reference lines, which have been added to it. The mooring line, which did not show in the previous picture owing to a reduction in size from the original, has also been retouched.

The lines r_1, r_2, r_3, drawn along the vertical edge of the radiators, and the lines *cc*, drawn along the vertical edges of the cabin, are parallel to one another in this picture, and are almost parallel to the line *t*, drawn along the vertical strut of the triplane cell. Their relative position is in absolute concordance with that found on a full side view of the ship, except that in the case of the latter the lines r_1, r_2, r_3 and *cc* are vertical, while here they are inclined owing to the angle at which this photograph was taken. The perfect correspondence of these lines on the two views would alone suffice to prove that the triplane cell is not out of alignment, but an additional proof of this fact is afforded by drawing a line *k* through the fourth rear strut of the keel, and a line k_1 through the stern beam. The angle these two lines form with one another is identical on both views, which disposes of the possibility that the rear end of the keel may have been out of alignment even if the triplane cell had remained in its normal relative position with respect to the rear end of the keel. Finally, the dotted lines *c* and r_3, drawn parallel to the full lines *c* and r_3, also show that there was no deformation of the keel.

The picture was sold to AVIATION as one taken "shortly before the accident," and the caption read accordingly. It has since been shown that the photograph was not taken at Langley Field on the day of the last flight, but at Bolling Field on Dec. 17, 1921. It was, however, given out by the Information Group, Air Service, after the accident. Accounts in the newspapers stated that eye witnesses saw the elevator inclined at an excessive angle, and as this picture appeared to have been taken on the day of the accident, it was published as an interesting illustration. This correction is therefore made so as to let those interested have the correct facts concerning the picture.

Speed Trials of Airships

A valued correspondent, who is well versed in airship matters, contributes the following remarks to our editorial in the March 6 issue, "Lessons from the Roma," in which under point 11 we asked: "Was the ship flying at a safe altitude considering its size and speed?"

Our correspondent says that "this question is especially pertinent in consideration of a report made by the late Major Pritchard, R.A.F., on the subject of the first speed trial of the R38. In this connection Major Pritchard reported that at an altitude of from 2000 to 2500 ft., when the motors were speeding up on the R38, the ship immediately began to hunt through a varying altitude of as much as 500 ft., and it took some time to steady the ship down, and for it to accommodate itself to changes in speed. For this reason he recommended that all future speed trials be carried out at a height of at least 3000 ft.

"In this connection it was probably possible with a ship of the Roma's size for such a condition to occur, and cause the accident without any injury happening the the controls of the ship."

While on this subject, we wish to call attention to the barograph record of the speed trials of the Forlanini airship F4 which is reproduced in the catalog of the Società Leonardo da Vinci of Milan, Italy, builders of the Forlanini airships. This record shows that on its speed trials the F4, which has about one half the capacity of the Roma, and which is a much slower ship, increased its altitude from 830 ft. (low speed) to 2000 ft. for the maximum speed. It will be seen that the Italian pilots did not consider it safe to proceed with full speed trials below an altitude of 2000 ft.

Future Development of the Fighting Airplane

Development of Two Types of Pursuit Airplanes Predicted: One for High Altitude Fighting and one for "Dog Fighting"

By Major F. M. Green

In considering the future development of fighting aircraft we must bear in mind that there are a number of different kinds of war and that the requirements of each kind are separate and distinct. It obviously is no use having aircraft specially designed and equipped for fighting enemy aircraft if the enemy have no aircraft to fight. Highly developed single-seater airplanes, therefore, are no use whatsoever in savage warfare. Again, the performance required of the fighter airplane depends chiefly upon the performance of the airplanes to which it is in opposition. If the enemy aircraft are not first rate then it is more economical to use a slightly slower fighter of more general utility than to use the fastest and most fined down machine that can be produced.

The single-seater fighters, therefore, will only become of great importance for first-class wars, and it is essential that their design shall always be at least as advanced as the airplanes of the enemy. It will always be possible to make a small machine carrying little load that is faster and more maneuverable than airplanes designed for heavier duties, for whatever improvements may be made in aeronautics are likely to affect the one type as much as the other. The safest way to ensure development, therefore, is to aim at a performance which is appreciably better than the best airplane of a larger type that the designer himself could make. It is not possible to know exactly what other people are doing, but we can feel fairly certain that if a designer is capable of designing a good fighting airplane at all, he will also be capable of knowing what the best performance is likely to be on a larger machine.

Armament

As the duty of the fighting airplane is to fight, the starting point for design should certainly be the armament, that is to say, the position and number of the machine guns or other weapons carried and the suitability of the airplane to enable the pilot to bring those guns into such a position that they can most effectively be used. Assuming for the moment that machine guns of the type used in the late war remain unchanged to any serious extent, then we have to decide the best number of machine guns to be carried, the amount of ammunition that should be taken and whether or not the guns should be fixed to fire straight ahead or whether we should attempt a bigger field of fire.

In air fighting the amount of time that the fighting airplane is in a favorable position to shoot at its opponents is likely to be very limited, and as accuracy of fire will probably never be great, it is essential to provide means for firing the greatest number of bullets during the favorable periods, or in other words, to have as many guns as possible which fire as rapidly as possible. On the other hand, the length of time that the airplane will be favorably situated for firing at its opponent depends upon the relative performance and maneuverability of the two airplanes. Adding more machine guns and carrying more ammunition will increase the size of the airplane, and will reduce both its performance and its maneuverability. As in all other matters of engineering design, therefore, we have to effect a compromise. There can be no rule for predicting what this compromise will be in the airplane yet to be designed. All we can say is, that at the end of the last war the equipment consisted of two machine guns each firing at the rate of 1,000 rounds per minute and that the ammunition carried was about 1,200 rounds. In more recent design it has been found possible to increase the ammunition to rather over 2,000 rounds. From the above considerations it can be safely said that anything which will increase the rate of fire in an airplane without increasing the weight will be a distinct advantage, and the writer thinks that this is one point in which we may look for improvement in the fighting power of future machines. It is convenient to use equipment similar to that which has been developed for land warfare, but at the same time it seems probable that the fighting power of our aircraft could be very much improved if a special gun were designed consisting of two, three, or more barrels in which the rate of fire were increased to perhaps twice that of the present equipment.

Hitherto we have only considered guns of the machine gun type. It is possible that advantage will be found in firing a bullet larger than those of the present calibre. It is also possible that guns will be produced firing something more of the nature of shrapnel. The writer prefers not to suggest development along these lines, but will content himself by remarking that whatever is produced must be small and light, otherwise the all-important power of dodging will be lost.

View

Having now decided that we must get a maximum rate of fire consistent with other factors, the next point to which we must give attention is to enable the pilot to place his airplane in a position favorable for using his guns. The chief points to be studied to enable this to be done are the view that can be obtained from the airplane, the speed of the airplane, its rate of climb and ceiling and the maneuverability of the machine.

The question of view is of an importance that can scarcely be exaggerated. The fighting pilot not only has to seek out the enemy aircraft, but must also be able to avoid being attacked unawares. His ideal field of view would of course have no

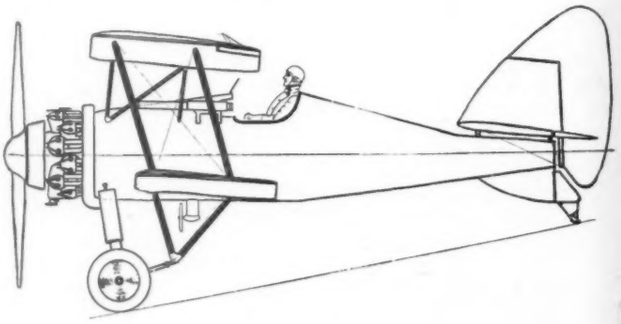


Fig. 1

obstructions at all, and this is obviously impossible. It is important that such obstructions as are unavoidable shall inconvenience him as little as possible. Experience has shown that it is almost essential that his view of the complete upper hemisphere should be unobstructed; that he shall be able to see down vertically over the side of the machine, and ahead and downward to as big an angle from the horizon as he is able to get. Various positions have been tried on tractor scouts. It is the writer's opinion that by far the best compromise is obtained when the pilot sits with his head in line with the chord of the top plane and not too close to it. The front of the fuslage should slope down toward the engine and the lower plane should be of as narrow chord as possible and have its trailing edge about vertically beneath the pilot. By this means the view in the upper hemisphere is unrestricted and the lower plane offers comparatively little obstruction (Fig. 1). In any case it is easy to dive the machine sharply for a moment in order to make sure that nothing is being hidden by the lower plane. It is obvious that a still better view could be obtained by having no lower plane;

in this case the airplane becomes a parasol monoplane. Unfortunately it is not easy to make an airplane of this type without certain compensating disadvantages, and in fact such an airplane has not up to the present been particularly successful. The disadvantage of a comparatively narrow lower plane is small, while the advantages from other points of view seem to make it worth while keeping to the biplane type.

Triplanes have been made and the narrow chord is of some slight advantage for view, but the fact that it is necessary to have three planes makes it impossible to obtain a view which is as good as in the type just described.

In an airplane designed by Captain De Haviland, known as the DH 5, the pilot was actually in front of the top plane, and was seated over the bottom plane to achieve this result.

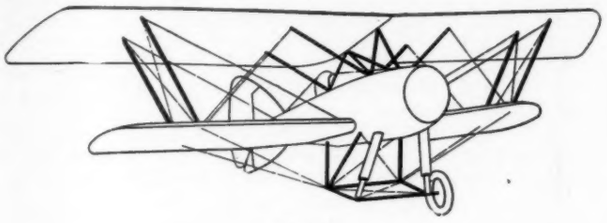


Fig. 2

The trouble with this for good visibility is that the view of the upper hemisphere behind the pilot is seriously obstructed. It is also rather worse for aerodynamic reasons.

A third type of scout was also much used in which the pilot was placed as close to the engine as possible and was seated more or less underneath the top plane. For visibility this is not good, as the top plane obscures a large portion of the upper hemisphere. To avoid this a hole is sometimes cut in the plane, but this is only a partial cure and is bad for aerodynamic reasons. In certain cases the pilot's head is actually in a hole in the top plane. This certainly allows a good view of the upper hemisphere, but it is inclined to be awkard and is not popular with pilots, who seem to be afraid that if the airplane does turn over on the ground they will be in for a bad time.

The chief objection that is generally raised to seating the pilot behind the top plane is that the moment of inertia of the whole airplane is increased, and this makes it slow to maneuver. For a long time it was claimed as one of the chief advantages of the rotary engine that it enabled the pilot to sit close up to the engine and produced an airplane which was extremely easy to maneuver fore and aft. The writer thinks there are two fallacies in this view. Firstly, the increased gyroscopic effect of the rotary engine is equivalent to an increased moment of inertia of the airplane, and it can easily be shown that the decrease of moment of inertia is more than compensated by the gyroscopic moment. The other fallacy is that as it is always easily possible to maneuver a small airplane fast enough in the fore and aft direction to break it, it is of no advantage to provide a quicker control than we have now without increasing the strength of the machine beyond what is practicable.

Ability to Withstand Damage

The structure of the airplane itself is a large target in comparison with the pilot and the vital parts of the engine. It will be a big advantage if the airplane is so designed that it is likely to lose little of its structural strength when hit by the bullets of the enemy. Wooden spars are generally of such a section that many bullet holes are unlikely to cause sufficient damage to make failure in the air likely. There is always the possibility that a wire or the attachment of a wire will be shot away, and it certainly seems a requirement of the modern airplane that the structure of the airplane should not depend upon any single wire or attachment. Duplicating a wire by means of another wire alongside is apt to be dangerous as one bullet is likely to destroy both wires. The lecturer knows of one case in which an airplane partly collapsed when a bullet hit the point of attachment of two wires which left the plane at different angles. The ideal arrangement, therefore, is to make a structure which is braced by two or more independent systems.

In the Siskin airplane, designed by the writer, the scheme of duplicated bracing has been carried out to a considerable degree of safety. It will be seen (Fig. 2) that the airplane is braced in the ordinary way by wires between the planes and that the wires are duplicated by the incidence bracing. In addition to the usual bracing there is a complete system of bracing to a king post under the body, which will give a fair factor of safety to the whole airplane if all the main bracing is shot away, so long as either the incidence bracing or the struts remain in place. We have in fact a structure in which the failure of any one wire increases the load on two other wires. It seems reasonable to suppose that a structure of this type is very nearly safe from failure in the air from anything less than a direct hit by a shell.

As regards damage to the power plant, air-cooled engines certainly are at a big advantage in comparison with those which are water cooled. The danger of having the water system pierced is considerable, and although this does not immediately bring down the airplane, the loss of water will certainly mean a seized engine in a very short time.

Fire

One of the greatest dangers to which a fighting pilot is subject is risk of being set on fire by an incendiary bullet. Toward the end of the war self-sealing tanks were introduced, which reduced this risk immensely. These, however, are rather difficult to make and add somewhat to the weight of the airplane. It seems possible that a similar effect might be obtained by surrounding the fuel tank with inert gas, as for instance cooled exhaust gas, and arranging to drain any accidental leakage of fuel overboard as effectively as possible. Unfortunately this would probably come out almost as heavy as the self-sealing tanks and would have the disadvantage that more fuel would be lost if the tank is hit.

Performance

In order that a fighting pilot shall be able to choose the most favorable position when engaged in an aerial combat it is necessary that he shall always be able to outmaneuver his opponent, and at first sight it might seem that speed is the chief requirement. Experience has shown that rate of climb is the governing factor; the airplane at the greater height can always obtain extra speed by diving, consequently the aim of the fighting pilot is generally to outclimb his opponent. In addition to this, the ability to climb is also to a large extent a measure of the ability to maneuver rapidly at height, for it is necessary to have excess power to be able to turn quickly without losing altitude.

There are many ways by which ability to climb at high altitudes can be increased. The ratio of horse power to weight can probably not be much increased as on certain airplanes this figure is no more than 7 lb. per hp. of the loaded airplane. Decreasing the wing loading in the general way increases the rate of climb, but it has other disadvantages. The most promising way of increasing the ceiling and the rate of climb at high altitudes is to design engines which give the same or nearly the same horsepower at considerable heights as they do at ground level. This has already been done experimentally in this country and elsewhere. The most successful means up to the present is to provide a centrifugal type of air compressor which increases the density of the air supplied to the engine so as to keep it at ground level density. The extra weight of the gear is not very great and it is possible to maintain almost the full horse power of the engine up to considerable altitudes. The same air compressor can be used to supply air at ground level density to the pilot, and thus the necessity for carrying oxygen can possibly be avoided.

By using air compressors there is really no reason why the ceiling of a scout airplane should not be increased from rather over 20,000 ft., as it is now, to 35,000 ft. or 40,000 ft. As it is probably too much to expect that pilots should fly at these great heights, the gear will be used rather to increase the rate of climb and maneuvering power of the airplane at altitudes of about 20,000 ft.

Maneuverability

As we have seen in the last paragraph, maneuverability is largely a matter of performance. At the same time all airplanes with similar performance have not equal power of maneuvering. It can easily be shown that the minimum circle in which an airplane can turn depends directly upon its stalling speed, hence the more lightly we load an airplane the more maneuverable we may expect it to be. Unfortunately it is equally obvious that the more rapidly we maneuver an airplane the stronger it needs to be; also the bigger the planes are, the heavier they will be. As usual, therefore, we have to arrive at a compromise which usually results in fighting scouts being loaded from 7 lb. to 9 lb. sq. ft.

Experience of the late war has shown that there are two distinct and separate types of fighting. In the one the fighting pilot climbs to a height well above his intended victim and attacks in one long dive. If he misses he makes use of his superior speed and climbs to gain height and to repeat the maneuver. The other type of fighting is that which takes place between airplanes which are very nearly equal in performance and frequently between large numbers of machines. In this case the airplanes maneuver round one another at fairly close range, each endeavoring to get into a favorable position to fire at the other and to avoid being fired at in return. For this type of fighting the more lightly the airplane is loaded the better, while in the former type heavy loading is an advantage rather than otherwise. The heavier-loaded airplane will dive faster and probably be steadier on the dive, but it will be less able to turn quickly and fight well in what is generally called a "dog fight." During the latter part of the war fighting airplanes fell actually into two classes—those of the SE5 type, which were fairly heavily loaded, were used for the former type of fighting, and those of the Sopwith Camel type were chiefly used for the latter. Whether or not it is possible to combine both types of fighter in one airplane is open to question, but it certainly seems probable that an airplane designed to do for both classes of fighting will be less effective than one which is designed either for the one class of fighting or the other.

Two-Seater Fighters

The case of the two-seater is much the same as the single-seater fighter, but the addition of the gunner makes it possible for the two-seater to fire in directions other than straight ahead. This to some extent makes up for the somewhat slower speed of maneuver from which all two-seater airplanes are likely to suffer on account of their increased size. The value of the two-seater will depend almost entirely up on the degree to which training in gunnery can be developed. The question of aimed fire from an airplane is one of considerable difficulty, and the more rapidly the airplane is maneuvered the more difficult does it become.

Gunnery

Although much experimental and research work was done toward improving the standard of aerial gunnery during the Great War, the conditions of training were such as to make it impossible to provide sufficient training to make the best of things. In the general way, the fixed gun firing straight ahead was as much as a pilot could manage, and comparatively few pilots became even passably expert. In special cases, as undoubtedly in that of the late Captain Ball, V.C., successful use was made of a Lewis gun fixed to the top plane, mounted so that the elevation could be altered, but comparatively few other pilots copied the example of that highly successful air fighter.

It seems to the writer that further development of aerial gunnery depends entirely on the attitude taken up by the Air Force authorities, and to the time and energy they are prepared to put into the training of our future fighting pilots. If there is the demand, it is certainly possible to arrange for movable guns which can fire through the propeller, or to make fighting airplanes in which the propeller is behind the pilot. It is also possible to arrange that the effort of moving the gun or guns can be provided mechanically, and that all the pilot has to do is to move the sight with the knowledge that the gun will turn with it. Mechanism of this type can be made, but it has little chance of being made unless the demand for it comes through the Royal Air Force itself.

It will probably be said that the suggestion of moving the gun and the airplane in different ways at the same time is hopelessly difficult and is scarcely worth attempting. The reply to this is that many other equally difficult things have seemed to be impossible, but gradual improvement in training has so developed the technique of it that what once appeared to be impossible now becomes comparatively easy.

If the Royal Air Force decide that such skill is necessary, then there is no doubt that it can be obtained and the type of fighting airplane may undergo a considerable change. It is probable that we can devise a synchronizing gear for a moving gun, but it is rather more likely that we shall devise a new type of airplane in which the propeller is not in the field of fire. A suggested design for such an airplane is shown in Fig. 3, where it will be seen that a propeller is put behind the pilot so that he obtains an unrestricted field of fire ahead.

Armor

It is not proposed in this paper to deal with the advantages and disadvantages of armoring airplanes. It is sufficient to say that offensive airplanes must always be superior in performance to the airplanes that it is intended to attack, and the addition of armor will certainly reduce performance. It is more likely that the fighting airplane will remain almost or quite unarmored and will depend upon its ability to dodge rather than upon its power to withstand rifle fire.

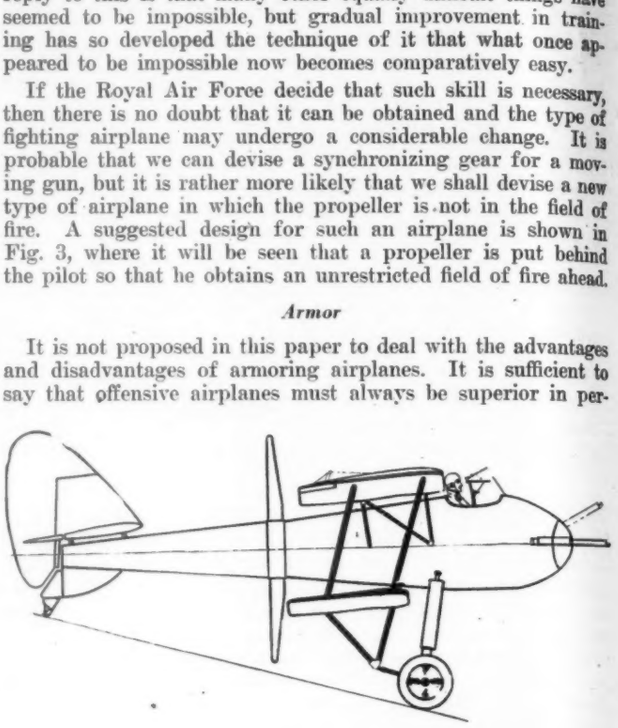


Fig. 3

Size

The size of airplane which is likely to be used on the air fighter in the future is a matter which cannot be settled easily. Certainly the smaller the airplane the quicker is it likely to maneuver. At the same time, so long as a minimum size is necessary to carry the standard armament that appears necessary, it is always possible that a pilot of abnormal skill will be able, on a small airplane carrying little ammunition and perhaps a single gun, to outmaneuver an airplane more heavily armed. The records of the Great War seem to show that the most successful airplanes on the whole were not the smallest. All we can say, then, is that the smallest size airplane that will carry the armament found by experience to be necessary is the airplane that should be used. The useful size appears to the writer to weigh in the neighborhood of a ton, and taking 8 lb. to the sq. ft. as the probable loading, this means a machine with about 280 sq. ft. of surface. An airplane of this size can be made extremely light to fly, and if the aspect ratio of planes is kept small, sufficient maneuverability can be obtained to ensure that it is not appreciably slower in this respect than any other airplane.

Small airplanes are undoubtedly attractive, and there is always likely to be a peace-time tendency to encourage the making of airplanes which will not carry sufficient armament to render them really valuable war-time machines.

The horse-power that will be used will probably be the most that can be obtained from a motor weighing about 700 to 750 lb. complete. What this will be the future will show. The writer thinks that in ten years' time it will be in the neighborhood of 400, and that this power will be maintained to a height of at least 10,000 ft.

The Fighting Airplane in the Future

It is very unsafe to predict the development of airplanes. All sorts of new inventions and discoveries will help to improve the type. Looking perhaps ten years ahead, the writer thinks that we may look forward to the development of two separate and distinct types of single-seater fighters—one adapted for attacking enemy aircraft in one long dive and the other more suitable for combined work and "dog fighting." The former type is likely to remain rather similar to that now in use. It will probably be of the conventional tractor type and which should certainly be armed in such a way that the rate of fire will be at least 4,000 rounds per minute, while the ammunition carried is likely to be some 3,000 rounds. The speed of the airplane at 20,000 ft. would be in the neighborhood of 160 m.p.h., while diving from that height a speed of 300 m.p.h. is likely to be attained. The rate of climb at 20,000 ft. should be 1,000 ft. per minute. Fuel for 2½ hr. at economical speed will probably be sufficient. The duties of this type of airplane will be to patrol the skies and to pounce on any unfortunate airplane which is trying to carry out reconnaissance, bombing or other duties.

The other type of airplane that should be developed is one in which the pilot has a clear field of fire ahead and in which almost everything is sacrificed to rapid maneuvering. The guns should be mounted so that they are moved by some form of servo motor in accord with a sight. The rate of fire in this airplane is not quite so important, possibly 2,000 rounds per minute will be sufficient, and the amount of ammunition carried should be the same as in the previous case, namely, 4,000 rounds. The speed of this type is not so important and possibly 150 m. p. h. at 10,000 ft. will be enough. The climb, however, should be at least 2,000 ft. per minute at that height, not with the idea of securing a high ceiling, as this machine will probably operate at comparatively low altitudes, but so as to get the maximum possible maneuvering power at any height. The amount of fuel to be carried is less certain and will probable be adjusted according to the ammunition carried or the performance required. The work of this airplane will probably be carried out in squadrons, and their duties will be to attack formations of enemy aircraft and to protect our own reconnaissance and bombing machines to some extent.

Two-Seater Fighters

Two-seater fighters of the future are harder to forecast. It is not certain that it will pay to keep two-seater fighters solely as fighting machines. It is more likely that this type would be developed as reconnaissance machines capable of fighting, but this will depend upon the system of training adapted by the Royal Air Force. Unless the training is carried out so that the crew have implicit confidence in one another and are accustomed to team-work, this type of airplane is doomed to failure. The superior initiative of the single-seater fighter will be the deciding factor. If, however, the pilot knows and trusts his gunner, then improved moral may prove the turning point.

The question of moral enters largely into the problem. The value to an air force of having the recognized best fighting machine is possibly as important as the actual damage which the fighting machines can do.

—Paper read before the Royal Aeronautical Society. (Excerpt)

French Air Transport Economics

A dispatch to the Philadelphia *Ledger* by Percy E. Noel, who, old timers will recall, edited some ten years ago the Chicago weekly *Aero and Hydro,* gives some interesting information on the economics of French commercial aviation.

Grouping all the French air lines, their operations in eighteen months from Jan 1, 1920, totaled 1,848,655 km., equal to four or five times around the world. The number of paying passengers went up by leaps and bounds, commencing with 239 in the first semester of 1920, increasing to 741 in the second semester and to 3430 in the first half of last year. Freight transportation increased equally fast, rising from 14,000 kg. in the first half of 1920 to 66,000 in the first half of 1921.

As business increased, so did the capital of private concerns and the companies operating, so that instead of five companies in early 1920, with only 2,500,000 francs of paid up capital, there were in the middle of 1921 eight companies, with more than 19,000,000 francs of paid up capital. The total receipts of the operating lines in eighteen months was 2,265,000 francs and expenses were 21,835,000 francs, or a difference of 19,570,000.

State intervention provided premiums of 14,387,000 francs, of which, more than 8,000,000 francs were for the last period tabulated. The net loss to the companies was thus 4,963,000 francs.

During 1920 and the first half of 1921 the average loss for each passenger carried was 1128 francs to the transport company and 3088 francs to the French Government. So the average amount disbursed for the privilege of carrying each average passenger was 5000 francs.

But little money was lost during the past six months of this period for the transport of passengers between London and Paris. On all lines there has been such a notable improvement in business in passenger, freight and mail for the past six months that the loss to some operating companies was reduced to a minimum and others made a profit, but the exploitation of the figures is significant of how heavy losses were sustained before bringing air transit to anything like a practical business basis.

A.S. Air Intermediate Depot

The Air Intermediate Depot of the Army Air Service, situated on the outskirts of San Antonio contains aviation materials valued at $50,000,000, while the machinery and other equipment that go to make up the plant has an additional value of $100,000,000.

It is one of the largest aviation and repair centers in the United States. The buildings which comprise the Government property are of permanent character. The special purpose of maintaining the depot is to keep constantly on hand a complete and large stock of airplanes and their parts for supplying the Army Air Service. The warehouses are filled with hundreds of airplane wings and motors. There are thousands of motors. Every three months these motors must be taken out of their boxes, thoroughly sprayed with grease to prevent rust and then treated to a coat of oil on the inside of the cylinders and other internal parts.

Several hundred complete airplanes are kept on hand in boxes in which they come from the factory, and these must also be opened at regular intervals, taken out and gone over completely.

In another part of the warehouse is an assortment of tools that probably surpasses in size and value any in the Southwest. Its value runs into millions of dollars. Every tool that will ever be needed in the Air Service is in the supply section. Spare parts stored in another part of the warehouse represent another huge fortune. This material goes to supply all the Army Air Service in the United States and, in addition, Panama, Philippine Islands, Hawaii and formerly the air forces in the Army of Occupation in Germany.

The engineering branch is charged with the repair of airplanes used by the Air Service in the 8th Corps area and in flying fields as far east as Florida. It is divided into several departments. There is the machine shop, one of the most complete in the country. Then comes the motor repair, fuselage construction, rigging, fabric and upholstery, paint shop, final assembly hangar and the test hangar. Airplanes are built from the ground up at the engineering branch, but for the most part they take the old ones that are turned in by the various fields and rebuild them.

The engineering branch was moved to San Antonio several months ago from Dallas, and took the buildings left by the Air Service mechanics school. Maj. William H. Garrison is in command of both branches of the depot.

The monthly payroll at the depot approximates $40,000, and there are about 400 civilians employed as mechanics in addition to the twelve officers. The supply branch is in charge of Lieut. Myron R. Wood and the engineering branch is in charge of Capt. Edward Laughlin.

Aviation and the Law

American Bar Association and Commissioners on Uniform State Laws Consider Proposed Federal and State Aeronautical Laws

For the first time in the history of American aeronautics, a joint meeting of subcommittees representing the American Bar Association and the Commissioners on Uniform State Laws was held in Washington, on Feb. 25, at which Army, Naval and civil aeronautical experts presented their views as to proposed federal and state aeronautical laws. They also asked for the cooperation and support of these two great legal organizations in the enactment of legislation for the development of aviation.

Favorable to Wadsworth Bill

While the joint committees took no action, it was developed as the sentiment of the session that the Wadsworth Bill (S-3076) for Federal control of interstate commerce in the air be endorsed, and that no specific legislation be recommended to the states that would in any way conflict with the idea of absolutely uniform regulation of air navigation. Aviation officials and aeronautical experts have held several conferences on the subject of national and state aviation laws, but the session held recently was the first time they have had an opportunity to meet with legal experts and state representatives and seek their interest and guidance.

Two general propositions were considered: First, the pending Wadsworth-Hicks Bill establishing a Bureau of Civil Aviation in the Department of Commerce to inspect aircraft, license operators, regulate navigation and operation of civil aircraft, designate air routes, recommend the establishment of air stations, suitable meteorological service, and study and develop aviation in general and, Second, the examination of a tentative draft of a proposed uniform state law prepared by Dr. Geo. C. Bogert, Dean of the Cornell Law School, and Chairman of Subcommittee on Aviation of the Commissioners on Uniform State Laws.

Those Present

Among those present were: Rear Admiral Wm. A. Moffett, Chief of the Naval Bureau of Aeronautics; Maj. Gen. Mason M. Patrick, Chief of Army Air Service; Geo. C. Bogert, Chairman of the subcommittee on Uniform State Laws; Wm. P. McCracken, Jr., of Chicago, Chairman of the subcommittee of the American Bar Association on the Law of Aviation; Rear Admiral Wm. F. Fullam, Retired, of New York; Maj. E. C. Johnson, Legal Advisory of the Army Air Service; C. F. Egge, Superintendent of the Air Mail Service; J. F. Victory, Secretary of the National Advisory Committee for Aeronautics; Howard E. Coffin; R. C. Bibbins, of the United States Chamber of Commerce; S. S. Bradley, of the Aeronautical Chamber of Commerce; E. C. Eli, Aircraft Underwriters' Association; Arthur K. Kuhn, New York; Chas. A. Boston, former chairman of the American Bar Association subcommittee; F. H. LaGuardia, of New York; Former Assistant Attorney General Frierson; F. H. Russell of the Curtiss Aeroplane and Motor Corp.; H. E. Hartney, Executive Secretary of the Aero Club of America; Temple N. Joyce of the Maryland State Aviation Commission; G. B. Cathell of the Curtiss company and other leading legal and aeronautical experts.

Action toward Aerial Regulation

Seeking some sort of action toward aerial regulation, Admiral Moffett said that while lawyers disagreed as to the constitutionality of aerial laws, he hoped that we could secure some sort of federal law, as an experiment at least, and asserted that the Supreme Court would settle whether it was constitutional. He pointed out the need of aerial laws, and cited as an example what a confusion automobile traffic and the highways in general would be in without laws.

General Patrick urged the support of the Wadsworth Bill, and said that in his opinion no legislation should be recommended to the individual states that might in any way conflict or interfere with Federal regulations when they are promulgated.

All the officials and individuals were asked to express their opinions on the subjects before the joint session by Chairman McCracken, who presided. A general discussion followed, several speakers advocating a safe and sane policy setting before the states the necessity of only the simplest form of state legislation which should deal with fundamental matters of sovereignty and ownership of the air, and be otherwise helpful to aviation without going into details of regulation and licensing.

The question of the constitutionality of previously proposed drafts of Federal legislation was discussed at length, and a number of speakers urged the necessity of a constitutional amendment giving the Federal Government exclusive sovereignty of the air and jurisdiction over all aerial navigation in the United States. The discussion disclosed, however that the pending Wadsworth Bill was clearly constitutional. It was also evident from the discussion that the conferees will revise the proposed uniform state aerial law incorporating the suggestions made.

Liability of Aircraft Owners

The liability of owners and operators of aircraft for damages to property on the ground was also discussed. On this question the draft submitted by Dr. Bogert undertakes to hold the owners and operators of aircraft liable for damages to all third persons and their property. Under the common law, it was pointed out, an operator of an airplane or other aircraft today would be liable to a reasonable degree, and that to extend the law in this direction would be not only unwise and unnecessary, but its psychological effect would be to place one more handicap on aviation development.

It was stated that the Wadsworth Bill has the approval of all governmental agencies concerned, including the Commerce Department, the Post Office, the Army and Navy air services, and the National Advisory Committee for Aeronautics. This bill, it was shown, plans to regulate interstate aerial commerce only, and it was urged that the states require that Federal licenses be secured by local operators for intrastate flying. With Federal licensing in operation, the states should enact laws defining sovereignty and ownership of space, and merely license in accordance with the Federal regulations, or better still, merely require that Federal licenses be secured by pilots for intrastate flying. State cooperation was absolutely necessary it was said by one speaker if the aerial laws were to function properly and make for safety in the air and on the ground.

It was understood that each of the subcommittees will report to its respective organization, and that these bodies will make appropriate recommendations in the matter.

Much gratification was expressed on all sides on the fulness and frankness of the discussion and it was the confident expectation of all that the law of aviation will have a rational development throughout the United States.

A. and D. R. Black

Owing to the slow development of commercial aviation, upon which "outside" engineers are largely dependent, A. & D. R. Black, consulting engineers, recently closed their New York office. They hope, however, that this will prove to be only temporary.

In the meantime their services as individuals will contiue to be available, although they will have no staff. Their mailing address is Garden City, N. Y.

Improvements in Aircraft Power Plants

Engines Should Embody Even Greater Lightness and Compactness Than Today, and Obtain Them without Sacrifice in Reliability

By R. J. Dolph

When we look back over a period of but a very few years and consider the present development of the internal combustion engine as it is now applied to the airplane, we are amazed at the wonderful improvement which has taken place, although we have not realized it from year to year. The change has come gradually and the present results have been gained through a general refinement in design, material and workmanship, there being no radical changes in the fundamental mechanical principles from the first successful automobile engine up to the present type of refined aviation engine.

The Present Situation

Our best aviation engines of today are truly wonderful machines when compared with the engines of a few years ago, and when we consider their fuel economy, piston speeds of 2000 ft. with 2000 r.p.m., and their ability to continually and reliably perform under varying conditions for from 100 to 300 hr., they surely are a tribute to their designers.

There have been many radical changes in plane design accompanied by a wonderful increase in performance although they owe a considerable amount of this increased action to the present stage of perfection of the engines. But notwithstanding the wonderful performance of the latest engines which seem to have well nigh reached perfection, and although the planes themselves offer plenty of room for refinement in design, these same engines are to a great extent retarding the development of the higher efficiency planes, especially in the smaller designs such as racing and fast military machines on account of their efficiency, weight and overall dimensions.

Although the weight of 1.5 to 2.5 lb. per hp. seems truly remarkable when one recalls the efforts of designers of a few years ago, the requirements of future performance call for even greater lightness and compactness, which must be obtained without any sacrifice of reliability or endurance but should be accompanied by a corresponding increase of same.

The Drawback of Encumbrance

The overall dimensions of the present engines are a drawback to the further refinement of the fuselage, especially in the average sized machine, as the forward portion of the body must depart from the best aerodynamical design in order to house the engine. If the proper form is maintained, it must be unnecessarily large, or portions of the engine must be left exposed, either of which materially affects the penetration with a corresponding decrease in the efficiency of the plane.

The large multimotored machines with separate engine nacelles are also affected in the same way, although possibly not to so large a percentage of the total performance, but nevertheless subtracting from its efficiency as a commercial carrier. Greater compactness would also tend toward the development of larger power units which would cut down the head resistance with its necessary overpowering requirements and uneconomical operation of multimotored planes. This would also tend to decrease the complication of engine installations and also the weight per horsepower, which would probably be accompanied by an increase in engine efficiency. All of this would tend to increase the range and efficiency of the machine.

With the present fuselage designs, the radiators or engine cylinders of the conventional six, eight or twelve cylinder type are both exposed to the air, offer a high head resistance and form a considerable percentage of the power necessary for the penetration of the fuselage. This unnecessary resistance is becoming more and more important as development advances, owing to the high speeds which designers are striving for and which must be realized as it is the greatest asset of the commercial airplane.

Any unnecessary resistance to forward motion must necessarily be accompanied by slower speed or more power, either of which means shorter range or greater fuel capacity and consequently less pay load. This is a direct blow to the efficiency we are striving for and to its commercial success. Any unnecessary weight of the power plant also directly affects the speed, especially in climbing, and consequently the range or fuel load and in turn the pay load of the commercial carrier. The exact extent to which these factors influence the performance and cost of operation can be obtained by a comparison of some of the articles published lately giving the specifications and performances of some of the latest successful commercial aircraft.

A reduction in weight and overall dimensions which adds greatly to the compactness of the power plant, also contributes in a great measure to the maneuverability of the airplane, which is greatly desired in military machines, especially of the pursuit type.

Rotary vs. Stationary Engines

One of the main advantages of the rotary type of engine in the smaller sizes has been their lightness and compactness due to their special design, and being especially adapted to air cooling. However, with the demands for greater power these motors had to give way to the "V" type on account of their low limit of speed, and consequently of efficiency and power. Also in the larger sizes their gyroscopic action is a detriment to maneuverability and they become difficult to house without excessive head resistance. The radial engine also has this undesirable feature and both the rotary and radial engines have, in their larger sizes on account of their excessive lateral dimensions, the attending difficulties of very long and complicated induction and exhaust systems.

Considering engines of average sizes, the requirements of lightness, compactness and accessibility seem to be met the best by the eight cylinder "V" engine as it is considerably shorter than the vertical six or "V" twelve with shorter crank shafts, cam shafts, induction and exhaust systems and therefore minus their attendant disadvantages and tending toward a more compact installation.

Regarding the overall dimensions, the present design of overhead valve gear contributes a large percentage to the height of the cylinders. Although the valve in the head construction with overhead cam shafts seems to be the most efficient arrangement as regard the combustion chamber design, location of multiple valves with their simplest operating mechanism, directness and length of gas passages, etc., it adds greatly to the overall height of the engine and to its complication, weight and expense of construction on account of the extra shafts and bevel gear drives. The present tendency in design toward long stroke engines also increases their height.

Radiator Design

Another important item considering future aviation power plants is the conventional form of radiators. The nose radiators, although not the most efficient for cooling, seems to offer advantages as to ease of mounting, accessibility, arrangement of piping, etc. But the forms of radiators in common use offer altogether too much head resistance at high speeds and are not efficient considering this large head resistance in connection with the work accomplished. The power plant may have a very efficient engine but when the negative effect of the radiator having a high head resistance is subtracted from this, instead of added to the resistance of the plans as is generally done, the total efficiency of the power plant may be rather low. The subject of radiator design is a very important one which has been much neglected and

copied from automobile practice, whereas aviation power plant radiators should be entirely different in design. The future requirements are for a radiator with greater cooling efficiency than is now obtained and with an almost negligible head resistance. In connection with the cooling system it may also be noted that all connections should be short and direct and of ample size and the pump should be very accessible for inspection.

It seems as though one of the greatest contributions toward less weight could be accomplished by the perfection of the air cooled engine which should be accompanied by an increase in efficiency to equal or surpass the water cooled engine. Air cooling may not greatly affect the weight of the engine proper, but it would entirely do away with the weight of the radiator, together with its power consuming head resistance, the cooling water, water pump and all the attendant piping and fittings, which would mean a considerable saving in the total weight of the power plant as well as simplifying the arrangement of the installations and thereby making for greater accessibility and reliability.

Fuel and Lubrication Systems

There is also room for improvement, regarding reliability and safety in the gasoline and lubricating systems. In many plane designs where it can be used to advantage the gravity system offers many advantages with its simplicity on account of much less piping and connections subject to vibration, and the elimination of the gasoline pump, control cocks, etc., with their many attendant troubles. There is also apparently opportunity for the further development of pressure and vacuum systems of fuel feed. It may also be stated here that a large percentage of the forced landings due to power plant troubles are traced directly to the gasoline system and are generally minor in character such as worn packing, clogging, loose connections and air or fuel leaks due to broken lines caused by vibration.

Regarding the lubricating systems, although adding to the engine dimensions but not in a detrimental direction, the crankcase reservoir appears to have many advantages over other arrangements. If properly designed, it helps to stiffen the crankcase and makes for more rigid construction of the entire engine unit. It also requires little or no piping outside the engine, the pumps are always submerged and all lines are short and direct with few connections. The fuel pump and oil pump regulating devices and all filters, etc., should always be placed in the most accessible positions to facilitate inspection and repairs.

Improvements in Induction System

Another very important item in connection with the engine is the inductions system. It is a very good plan to have the carburetor low with the air scoop below the fuselage as it allows the fuel in cases of leaks or flooding to fall to the ground thereby lessening the risk of fire, and it also allows of good accessibility, but, on the other hand, it requires very long and inefficient induction manifolds with their objections to condensation with temperature and mixture fluctuations and hard starting characteristics. Very free gas passage is desired with present high piston speeds so it would seem advantageous to place the carburetor high where the passages could be as short and direct as possible where it greatly facilitates the functioning of the carburetor and does away with the above attendant difficulties of the long induction manifold. The carburetor can be made readily accessible and a separate drain pipe can be led from the air intake to the bottom of the engine compartment, and the air horn may project out near the top of the cowling if desired. Sometimes very good carburetors are blamed for troubles caused by poorly designed induction manifolds and special attention directed to the design of both carburetor and manifold very often adds several points to the fuel economy of the engine as well as making for more reliable performance. Attention should also be directed to more efficient and reliable operation at high altitudes in which connection it would seem apparent that an automatic compression pressure control would improve the commercial serviceability.

The proper functioning of the ignition system is also a very important factor in the efficient operation of the engine. The ignition system should be in duplicate, with circuit breakers very accessible for inspection and adjustment, and with easy and reliable means for absolute synchronizing. All wiring should be well housed and protected from oil, water and vibration. Spark plugs should be most efficiently placed in the combustion chamber but the engine cowling should be so arranged that they may be easily inspected or removed for cleaning.

Other types of engines which offer possibilities are the Diesel and semi-Diesel types. These engines have not attracted much attention in connection with aircraft, especially in this country, but with their possibilities of refinements in design, they apparently offer many advantages in adaptation to certain classes of aircraft.

Cost of Construction

Another point in connection with the design of engines which has been neglected so far on account of striving for performance at any cost, is the cost of construction. The present types of successful aircraft engines are too costly for the average commercial planes which are in demand, and engines should be developed which will allow of quantity production at reasonable prices without sacrificing anything in efficiency and reliability.

And last but not least, is the very important fact that the present tendency toward the design of thick winged monoplanes will eventually call for engines of suitable characteristics for mounting entirely within the leading edge of the wing and also be of such shape as to be easily accessible, easy to get at and dismantle and repair while in the air. The present engine designs are not very well adapted for such mounting without deforming the contour of the wing, which would place them in such position as to be very inaccessible. Mounting them farther back toward the center of the cord, and using a longer propeller shaft to reach through the leading edge, would naturally mean a heavier and more costly installation and also occupy valuable space.

In view of future requirements and in summing up the past accomplishments, the writer believes that the aviation power plant of the near future will make use of an engine of considerably less weight per horsepower and be much more compact with a corresponding advance in the direction of greater simplicity, reliability and accessibility. There is also reason to believe that the development of new metals, improved methods of construction and workmanship will, as in the past, continue to lighten and improve present construction to a considerable extent. Possibly some radical changes in the arrangements of the major components of the engines will also take place and we can expect the efficiency to keep step with the gradual improvement in design.

French Air Budget

The French Air Budget for 1922, as passed by Parliament, totals approximately 436 million francs. The main appropriations are: Minister of War: For Home Squadrons, 214,287,500 francs; Algeria and Tunis 9,936,490 francs, Morocco, 22,173,092 francs; total 246,397,082 francs. Under Secretary of State Department for Aeronautics: 147,219,970 francs, which includes foreign air attaches, 200,000 francs; technical service, 5,400,000 francs; prizes and subsidies for commercial aviation, 45,382,000 francs. Ministry of Marine, 37,318,543 francs; Ministry of Colonies, 4,991,000 francs.

Of considerable interest and importance are the figures now available for the past year's growth of flights and passengers and freight carried. For the full twelve months to Dec. 31, 1921, compared with 1920, the figures are: 1921—Flights, 4022; passengers, 13,369; goods, 150,309 kg.; mails, 3308 kg. 1920—Flights, 3359; passengers 6850; goods, 120,745 kg..; mails, 1474 kg. For the month of December the figures are: 148 flights (arrivals and departures), 359 passengers, 7277 kg. of freight, and 84 kg. of mails. These figures are for the airways in operation between Paris and London; Paris, Brussels and Amsterdam; Paris, Strasbourg, Prague and Warsaw; Paris and Amsterdam; and Paris to Havre.

"Who's Who in American Aeronautics"

(Copyright, 1921, by The Gardner, Moffat Co., Inc.)

The biographical sketches of men who are prominent in American Aeronautics are printed periodically in AVIATION. The first series will be shortly published in a more durable form, and revised issues will be published semi-annually to take care of the frequent changes in station of Army and Navy officers, and such other changes as may occur. As errors and omissions are liable to occur in a compilation of this character, interested parties are requested to notify "Who's Who" Editor of the necessary corrections so the record may be kept up to date.

John H. Towers

TOWERS, JOHN H., Commander, U.S.N.; born, Rome, Ga., Jan. 30, 1885; son of William Magee Towers and Mary (Norton) Towers; married, Lily Carstairs, Oct. 5, 1915.

Educated: Public schools of Rome, Ga.; Georgia Institute of Technology; Naval Academy, Class of 1906.

Professional: Sea duty on Kentucky and Michigan, March 1905 to June 1911; aviation duty since 1911; Assistant Naval Attache, London, 1914-1916.

Aeronautical Activities: Started flying, June 1911, under instruction of Glenn Curtiss; on various aviation duties since; in command of Trans-Atlantic Flight, May 1919.

Flying Rating: Naval Aviator No. 3; Aero Club of America Certificate, No. 62.

War Honors: Navy Cross, Royal Force Cross, Commandant Order of Tower and Sword (Portugal).

Member: Army and Navy Club, (Wash.); Chevy Chase Club; Racquet Club of Washington; University and Racquet Clubs of Philadelphia; Aero Club of America; New York Yacht Club.

Present Occupation: Commander, U.S.S. Aroostook.

Address: Naval Air Station, Pensacola, Fla.; home, 1715-19th St. N. W., Washington, D. C.

Cole J. Younger

YOUNGER, COLE J., Bank Examiner; born, Norfolk, Nebr., June 14, 1894; son of H. R. Newmann and Mary H. Uewmann.

Educated: Northwestern University.

Professional: Bank Examiner.

Aeronautical Activities: Joined U. S. Air Service, Paris, France, Aug. 1917; received French brevet at Tours, France, Sept. 1917; commissioned 1st Lieut., Jan. 1918; remained on flying status until release, June 1919; Vice Chairman, Contest Committee of American Flying Club in conduct of New York-Toronto Airplane Race and New York-San Francisco Airplane Race; Assistant Manager, 1920 New York Aero Show; Sales Manager, Ordnance Engineering Corp.

Flying Rating: Reserve Military Aviator, Sept. 1917.

War Service: As above.

Member: Aero Club of America; Chairman, House Committee, Aero Club of America.

Present Occupation: Bank Examiner.

Address: 720 Customs Bldg.; home, 230 Fifth Avenue East, New York City.

Henry I. Hoot

HOOT, HENRY I., Junior Mechanical Engineer; born, Lewistown, Pa., June 19, 1897; son of Henry Z. Hoot and Mary T. Hoot; married, Alice B. Fricke, Sept. 8, 1921.

Educated: Friends' Central School, Philadelphia, Pa.; A.B. 1920, Mechanical Engineering, Swarthmore College, Swarthmore, Pa.

Professional: Engineer for Philadelphia Electric Co., 1917.

Aeronautical Activities: Test Section, Naval Aircraft Factory, Philadelphia, Pa., 1918; National Advisory Committee for Aeronautics, Research Laboratory, Langley Field, June 1920 to date.

Present Occupation: Junior Mechanical Engineer, Aeronautical Research Laboratory.

Address: Langley Field, Va.; home, Newport News, Va.

Harold Wesley Tennant

TENNANT, HAROLD WESLEY, Civilian Aviator; born, Athelston, Iowa, June 7, 1896; son of H. R. Tennant and Jessie M. Tennant.

Educated: Elkpoint, S. Dak. High School; Electrical Engineering, University of South Dakota.

Professional: Wholesale grocery business.

Aeronautical Activities: Enlisted in Air Service, 1917; instructor on motors, 1918; Captain in Reserves, 1919; civilian flying to date.

Flying Rating: Airplane Pilot.

Member: American Association of Engineers.

Present Occupation: Wholesale grocery business and civilian aviator.

Address: 715 South Dakota Ave., Sioux Falls, S. Dak.

Harold James Brow

BROW, HAROLD JAMES, Lieut., U. S. Navy; born, Fall River, Mass., Dec. 30, 1894; son of Willis H. Brow and Louisa A. Brow.

Educated: Public schools of Providence, R. I.; Technical High School.

Professional: 1914-1917, Machinery designer with the Beaman & Smith Co., Providence, R. I.

Aeronautical Activities: Ground School, Mass. Inst. of Tech., Oct. 1917 to Jan. 1918, flight training (seaplane), 1918; Patrol Pilot, Instructor, Division Commander, Inspection Officer, Assistant Engineer Officer, Naval Air Station, Miami, Fla., May 1918 to July 1919; Experimental Pilot, N.A.S., Hampton Roads, Va., July 1919 to Feb. 1920; Pursuit Course, Carlstrom Field, Arcadia, Fla., Feb. to May 1920; Torpedo-Plane Course, N.A.S., Pensacola, Fla., May to July 1920; Atlantic Fleet Torpedo-Plane Squadron, Hampton Roads and Yorktown, Va., July 1920 to Dec. 1921; piloted Navy Martin Bombers in Bombing Exercises on ex-German battleships, June and July, 1921; Assistant Radio Officer, N.A.S., Anacostia, D. C. to date.

Flying Rating: Naval Aviator No. 571, Feb. 1918; Aero Club of America Certificates Hydro-aeroplane No. 474 and Airplane No. 4171.

War Service: April 1917 to date; commissioned Lieut., U. S. Navy, Dec. 1921.

Member: Army and Navy Club of America (N.Y.C.)

Present Occupation: Lieut., U. S. Navy; Test Pilot, Naval Air Station.

Address: Naval Air Station, Anacostia, D. C.; home, 95 Peace St., Providence, R. I.

Sylvanus Charles Coon

COON, SYLVANUS CHARLES, Commercial Aviation; born, Fulton County, N. Y., May 29, 1886; son of Charles Sydmore Coon and Nannette (Wilcox) Coon.

Educated: Public and private schools, New York State; 1904-1907, Mechanical Engineering, private school, New York City.

Professional: 1904-1906, Mechanical Superintendent, Fiat Automobile Co.; 1907-1911, Mechanical Superintendent, Palmer-Singer Automobile Co.; 1911-1917, Treas. and Gen. Mgr., Orenco Engineering Corp.

Aeronautical Activities: Captain, Air Service, March 1918 to Aug. 1919; assigned to Call Field as 1st Assistant Engineering Officer, O.I.C. Cadet Gas Engine Instruction; Investigations of Engine and Plane failures for Eng. Division, March to June 1918; appointed Chief Engineer Officer of Mather Field, organized Eng. Dept., received flying training, carried on test, directed improvements of safety nature on training plane in cooperation with Western Dept. B.A.P. and local manufacturers; assigned to overseas duty Nov. 1918; joined Curtiss Aeroplane & Motor Corp., Aug. 1919.

Flying Rating: Reserve Military Aviator.

Member: Aero Club of America; Aeronautical Chamber of Commerce.

Present Occupation: Southwestern representative, Curtiss Aeroplane & Motor Corp.

Address: Love Field; home, Adolphus Hotel, Dallas, Tex.

Arthur R. Houghton

HOUGHTON, ARTHUR R., Lieut., U. S. Navy; born, Falmouth, England, March 14, 1893; son of George Houghton and Agnes B. Houghton; married, Helen E. Brown, April 20, 1918.

Educated: Lancaster, Mass. High School; Boston English High School; Mass. Agricultural College, Amherst, Mass., 1915.

Professional: Instructor, public schools, Porto Rico, 1916.

Aeronautical Activities: Akron, Ohio, Oct. 1917 to Dec. 1917; Naval Air Station, Cape May, N. J., Jan. 1918 to April 1919; Naval Air Station, Chatham, Mass., May to July 1919; Naval Air Station, Rockaway, July 1919 to March 1920; Naval Rigid Airship Detachment (ZR2), Howden, England, April 1920 to July 1921; Naval Air Station, Lakehurst, N. J., July 1921 to date.

Flying Rating: Naval Aviator, June 1918.

War Service: U. S. Navy, July 1917 to Feb. 1922.

Present Occupation: Lieut., U. S. Navy.

Address: Naval Air Station, Lakehurst, N. J.

Roy Stanley Geiger

GEIGER, ROY STANLEY, Major, Marine Corps; born, Middleburg, Fla., Jan. 25, 1885; son of Marion F. Geiger and Josephine (Prevatte) Geiger; married, Ennice Renshaw Thompson, July 12, 1917.

Educated: Florida State Normal; LL.B. 1907, Stetson University; University of Chicago.

Professional: Admitted to the Bar, Circuit and Supreme Courts, State of Florida and United States District Court, 1907; commissioned 2nd Lieut. in the Marine Corps, 1909; served at sea, Panama, Nicaragua, Philippine Islands, China, and assigned to aviation duties, 1916.

Aeronautical Activities: Aeronautical instruction, Naval Air Station, Pensacola, Fla., 1916-1917; St. Louis Free Balloon School, 1917; Army Balloon School, Ft. Omaha, Nebr.; in command of Marine Flying Field, Miami, Fla., 1918.

Flying Rating: Naval Aviator; Free Balloon Pilot (Aero Club License).

War Service: Commanded Squadron No. 7, Marine Corps, Northern Bombing Group, France, 1918; attached to British Squadron No. 217; commanded Fourth Air Squadron, Port au Prince, Republic of Haiti, 1919-1920.

War Honors: Navy Cross.

Member: Army and Navy Club (Wash.); Aero Club of America.

Present Occupation: Commanding Marine Flying Field, Marine Barracks, Quantico, Va.

Address: Marine Flying Field, Marine Barracks, Quantico, Va.

Archibald Black

BLACK, ARCHIBALD, Aeronautical Engineer; born, Inverness, Scotland, October 2, 1888; son of John Black and Marjorie (Robb) Black.

Educated: Public schools in Scotland; Cooper Institute, New York; Cass Technical Institute, Detroit.

Professional: With New York Edison Co., Union Metallic Cartridge Co. (Bridgeport, Conn.), Detroit Edison Co., 1902-1915.

Aeronautical Activities: Curtiss Aeroplane Co., Buffalo, N. Y., 1916; Chief Engineer L.W.F. Engineering Corp., 1917-1918; Engineer in charge of Aeronautical Specifications, Bureau of Construction and Repair, U. S. N., Washington, D. C., 1919-1920; Consulting Aeronautical Engineer with A. & D. R. Black, 1920 to date; August 1917; Consulting Engineer, U. S. Aerial Mail, 1921.

Member: American Soc. Mechanical Eng.; Soc. Automotive Eng.; Amer. Soc. Testing Materials; Amer. Soc. Eng.; Aero Club of Amer.

Present Occupation: Consulting Aeronautical Engineer.

Address: 25 Brixton Road, Garden City, L. I., N. Y.

Earle Henry Carlisle

CARLISLE, EARLE HENRY, Commercial Aviation; born, Stanley, Wis., Sept. 9, 1900; son of Henry Wood Carlisle and J. F. Carlisle.

Educated: Central High School, Minneapolis, Minn.

Aeronautical Activities: Handley-Page test pilot, Dec. 1919 to June 1920; Exhibition flying and passenger carrying Sept.-Dec. 1920; Instructor, Canadian Air Force, Camp Borden, Dec. 30 to April 1, 1921.

War Service: Flying Cadet (Canada), Sept. 1, 1916 to June 1, 1917; Pilot Officer (England), July 1 to Sept. 1, 1917; Flying Officer (France), Sept. 5, 1917 to Sept. 1, 1918; Flight Lieutenant (Russia) April to Nov. 1919.

Present Occupation: Commercial Pilot.

Address: 3935 Clinton Ave. South, Minneapolis, Minn.

Edmund R. Tennant

TENNANT, EDMUND R., Civilian Aviator; born, DesMoines, Iowa, Jan. 7, 1901; son of H. R. Tennant and Jessie M. Tennant.

Educated: Public schools of Elkpoint, S. Dak.; Central High School, Sioux Falls, S. Dak.

Aeronautical Activities: Exhibition flying; aerial acrobat.

Present Occupation: Civilian flying.

Address: 715 South Dakota Ave., Sioux Falls, S. Dak.

Preparing Altitude Records

By Col. A. Guidoni

It was with deep admiration that I read the report of Lieutenant McReady on his last exploit, and I do not know whether I appreciate the work of the engineer who prepared the machine and the supercharger more than the performance of the pilot who resisted bravely to all the adverse elements encountered in his flight.

Being accustomed, in my long career of constructor and engineer, to reduce all eventualities to a minimum, I asked myself if it would not be possible to complete on the ground such tests which would insure the man against unforseen circumstances and their effects. I mean to repeat for the man, that which has been carefully done and with the best results for the engine.

As soon as the idea of a great altitude flight passed from the theoretical field to the practical one, the scientists understood the advantages of putting the engine through laboratory tests in the same conditions of pressure and temperature which would be met at said altitude. The Bureau of Standards had the first laboratory in which it was possible to take all the measurements regarding aviation engines, placing them in an atmosphere at the same temperature and pressure of the altitude of many thousand feet. But if the engine is a very important part of the machine, it is not to be forgotten that the pilot plays also a big part in the performance.

Perhaps it has been thought that the nature could adapt the human organism to the peculiar conditions at a great altitude better than engineering, and that it would only be necessary to furnish him with some oxygen in order to maintain his normal functions. The performances of Major Schroeder and Lieutenant McReady have proved, on the contrary, that if great care is taken of the engine, a greater care must be taken of the pilots, and that the secondary parts of the devices which assure physiological functions of the pilots are as important as the turbocompressor.

This being accepted, I think that the plants which the Bureau of Standards has built to test engines, could be used very well to test the pilots and his devices. Experiments ought to be made gradually; the temperature and pressure ought to be lowered gradually, to the value corresponding to 20,000, 30,000 and 40,000 ft. The windows in the walls would permit the witness to follow the condition of the man, and stop the test if any inconvenience should arise. The object of the tests would be mainly to improve and develop the details of the devices, in order to see that they work well, not only for few minutes but for a reasonable length of time.

The principal need of aviation is to rely on the ability of mediocre men. Everybody, for many years, in talking of the future of aviation, has predicted that the future of flight would be at great altitudes; not until there is the need of such wonderful and special men like Schroeder and McReady, so as to reach 40,000 ft., does it become doubtful that those performances will aid in solving the practical problem of aviation.

It is well that humanity has types of men like those two, but it is better not to have to rely entirely on them in order to obtain practical results.

Merger of French Air Lines

The Compagnie Générale de Transport Aérien of Paris which was the operating branch of Farman Frères, and which ran up to Jan. 1, 1922, a daily passenger and mail service between Paris and Amsterdam with Farman Goliath airplanes, has merged with the Messageries Aériennes of Paris. As a result of this merger the Messageries Aériennes will take over the Paris-Amsterdam service, and will inaugurate this year a daily service between Paris and Marseilles.

This amalgamation makes of the Messageries Aériennes the largest French air transport firm backed exclusively by aircraft manufacturers, the parent firms including Blériot, Bréguet, Caudron, Farman and Morane-Saulnier. The merger will enable the Messageries Aériennes to put Farman Goliath airplanes on the Paris-London service, and so compete on even terms with the other French air line operating between Paris and London, the Grands Express, which has been using these machines with considerable success. So far the Messageries Aériennes has exclusively used six-seater Spad 33 and five-seated Bréguet machines on this line, but their limited capacity proved inadequate to take care of the large passenger traffic during the summer months.

THE CONTEST COMMITTEE
of the
AERO CLUB OF AMERICA

Requests all owners (individuals or companies) of aircraft in the United States to register in order that the Committee may

1. Send, gratis, the Aero Club's Contest Rules for 1922, and notices of proposed aviation meets.
2. Assist local Clubs in organizing contests best adapted to the types of airplanes in their locality.
3. Have a record of airplanes and pilots available throughout the country in times of emergency.

USE THIS FORM.

CONTEST COMMITTEE, AERO CLUB OF AMERICA;
11 East 38th Street, New York City

Date .....

I / We) have ..... (Give number) (Airplanes) (Seaplanes) (Flying Boats) (Airships) (Free Balloons)

Make and Model .....

Motor, Make and Model .....

Maximum speed of .....m.p.h.

Capable of continuous flights of ..... miles

Cubic capacity of gas bag ..... cu. ft.

Underwriters' Laboratories Aircraft Registration No. .....

Pilot's name .....

Address .....

Owner's name .....

Address .....

Naval Aviation News

The aircraft carrier Langley, formerly the Jupiter, whose conversion from a collier is well toward completion at the Norfolk Navy Yard, will probably not be commissioned until about May 1, it is said at the Bureau of Naval Aeronautics.

As a commander of this first, though a second line airplane carrier, Capt. Stafford H. R. Doyle, now in charge of the Naval Air Station at Hampton Roads, is slated, although his orders have not been signed. Comdr. Kenneth Whiting, has been designated by the Bureau as Executive Officer of the Langley, and Lt. Comdr. Hugh McCabe, has been ordered to report aboard to act as navigator when the vessel is put into service. Lt. Comdr. Harold R. Keller has been detached from the Boston Yard and ordered to the Langley as First Lieutenant; Lieut. Frank C. Fechteler, has also been detailed to the Langley Aviation Detachment from Annapolis, and Machinist Frank L. Elkine and Pay Clerk D. A. Palmer have also been order aboard the ship.

Other recent Naval Aviation orders include the transfer of Lieut. James S. Day, Chaplain, from the Charleston Yard to Shawmut, now flag ship of the Atlantic Air Squadrons. Lieuts. Charles A. Rowe, Harold R. Stiles and Russell L. Davison and Ensign Z. R. Strope have been detached from the Hampton Roads Air Station and ordered to their homes. Lieut. Guy McLaughlin was recently detached from the Aroostock, Flagship of the Pacific Air Squadrons, and ordered to the Pensacola station.

Lieut. A. J. Williams, has been ordered from the Atlantic Fleet Torpedo Plane Squadron to the Hampton Roads Air Station. Lieut. A. M. Darby, has been ordered home from Pensacola and Lieut. Leon Dancer to the Hampton Roads station.

Huff-Daland in Kansas City

Huff, Daland, Inc. of Ogdensburg, N. Y. announces the opening of a sales office and flying field for instruction purposes in Kansas City, Mo. under the name of Huff-Daland Aero Corp., who will be the sole distributors of their airplane products.

Archibald B. Johnson is sales manager of the new corporation, and he and vice-president George B. Post will control operations in the West. One of the new Huff-Daland "Petrel" three-seater commercial airplanes, which was described in detail in the Feb. 6 issue of AVIATION, is already enroute to Kansas City for demonstration purposes.

The new company has opened an office at 1018 Commerce Bldg., Kansas City, Mo., while the flying field and hangar facilities will be jointly used through the courtesy of the Kansas City Flying Club.

The Farman A2 two-seater observation-combat airplane of the French air service

Air Service Instruction Course

Boards are now examining candidates from civil life and enlisted men of the Army for appointment as flying cadets to attend the school scheduled to open about July 1, probably at Kelly or Carlstrom Field.

Flying cadets receive the base pay of $75 per month, which includes extra pay for flying risk. The ration allowance will not exceed $1 per day and other allowances, such as clothing and equipment of those of a private first class, Air Service.

Applicants from civil life will be required to pay all expenses incident to their appearance before the examining board for examination and no claim for reimbursement of the expenses incurred prior to enlistment will be considered. Candidates must enlist for three years, but will be discharged upon completion or failure to complete the prescribed course.

Cadets who successfully complete the course of training will be commissioned second lieutenants in the Air Service Officers' Reserve Corps (inactive status), and upon their discharge will receive travel pay and other allowances as are given other enlisted men when discharged from the service.

Examining boards are now located at the following stations: Mitchel Field, Long Island, N. Y.; Bolling Field, Anascostia, D. C.; Langley Field, Hampton, Va.; Aviation Repair Depot, Montgomery, Ala.; Carlstrom Field, Arcadia, Fla.; McCook Field, Dayton, Ohio; Chanute Field, Rantoul, Ill.; Scott Field, Belleville, Ill.; Post Field, Fort Sill, Okla.; Kelly Field, San Antonio, Texas; Ellington Field, Houston, Texas; Crissy Field, San Francisco, Calif.; March Field, Riverside, Calif.; Mather Field, Sacramento, Calif.; Ross Field, Arcadia, Calif.; Philippine Department, Manila, P. I.; Hawaiian Department, Luke Field, H. T.; Panama Canal Department, Christobal, C. Z.

Schoen Field

In honor of Lieut. Karl J. Schoen, 137th Aero Squadron, who was killed in action at Verdun Oct. 29, 1918, the airdrome at the headquarters of the 5th Corps Area, Fort Benjamin Harrison, Ind., will be named "Schoen Field."

When commissioned in the Air Service, his residence was given at 5201 College avenue, Indianapolis, Ind. His Distinguished Service Cross citation reads as follows:

"For extraordinary heroism in action near Aincreville, France, Oct. 10, 1918. While leading a patrol of three machines he sighted nine enemy planes (Fokker type) and immediately attacked them. Although greatly outnumbered, he destroyed one of the planes and put the others to flight. He was killed in action Oct. 29, 1918, and has been officially credited with destroying seven enemy aircraft."

Coming Aeronautical Events

AMERICAN

Apr. 30 — *Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.*

May — *National Balloon Race.*

Sept. 4 (about) — *Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)*

Sept. 15 (about) — *Detroit Aerial Derby, Detroit. (Pulitzer Trophy Race.)*

Sept. 30 — *First Annual Interservice Championship Meet. (In preparation.)*

FOREIGN

Aug. 1 (about) — *Coupe Jacques Schneider. (Seaplane speed race.) Italy, probably Naples.*

Aug. 6 — *Gordon Bennett Balloon Race, Geneva, Switzerland.*

Aug. 6-20 — *Soaring and Gliding Competition, Clermont-Ferrand, France.*

Sept. 22 — *Coupe Henri Deutsch de la Meurthe. (Airplane speed race.) France.*

American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

Aeronautical Briefs

Flying to the Farthest North.—Pilot Martin and Captain Maxwell, flying an airplane equipped with runners in place of wheels for the "take off," recently completed a successful trip from Cochrane, Ont., the nothern rail outpost, to Moose Factory, on the south shore of the Hudson Bay, and return.

The airplane, carrying mail and supplies weighing 200 lb., left Cochrane at four o'clock in the afternoon and two hours and ten minutes later, with one stop, arrived safely at Moose Factory.

On the return trip three landings were made on the Abitibi river to test the machine with different snow conditions. The ski attachments, Captain Maxwell reported, were found to be practical, his ship landing and taking off with the ease of a flying boat on open water.

Fast Flying between Washington and Dayton.—What is considered a record non-stop flight between Dayton, Ohio, and Washington, D. C., was made by Lieut. C. V. Haynes, Air Service, on Feb. 4, in a special DH4B Messenger ship, the trip consuming 2 hr. 55 min. The distance between Washington and Dayton is 440 miles, making the rate of speed traveled by this plane slightly in excess of 147 m.p.h.

Federal Air Legislation.—The Wadsworth-Hicks bill, which passed the Senate on Feb. 14, is now before the House Committee on Interstate and Foreign Commerce.

Airplane Crosses Atlas Mountains.—For the first time, a commercial airplane has flown across the Atlas Mountains in Morocco, according to a message received at the London Air Station. The Atlas range is 15,000 ft. high. The pilot was Alan J. Cobham, an English aviator.

Safety of British Air Lines.—Not one passenger has been killed, or even seriously injured, in a British civil airplane throughout 1921, although during the summer between four hundred and five hundred people a week were crossing the Channel by air, and although well over one thousand a week were being taken up for joy rides. Credit for this showing goes not only to the skill of the pilots and airplane mechanics but also to the aeronautical inspection department and the controller of airdromes and licenses, who have made sure that only first-class men and machines have been allowed to carry passengers.

Aerial Photography and Ethnology.—For the first time, an American archaeologist has used aerial photography to obtain bird's-eye views of the oldest man-made topographical features of America, the Indian mounds. David I. Bushnell, Jr., is using such photographs of the mounds near East St. Louis to illustrate a report of the bureau of ethnology of the Smithsonian institution at Washington.

Airplane Assists Bank.—An airplane laden with sufficient money to pay all depositors of a bank at El Dorado, Ark., was recently dispatched from Shreveport, La.

The airplane was sent off following a run on the bank due to a false report that it was insolvent.

Air Taxis for American Tourists.—A regular taxiplane service for the benefit of passengers on trans-Atlantic liners will begin at Liverpool and at Southampton before the annual Spring rush of tourist travel from the United States sets in. Passengers will be able to wireless a central airport in London from sea and order a plane to meet them at the ship in Southampton or Liverpool. The planes will deliver passengers to any point in the British Isles or on the Continent.

Canadian Activities.—A Martinside airplane piloted by Major Cotton will be used this spring in Canada in connection with the seal hunt. She will act as a scout, reporting the location of the herds to steamers.

While portions of the Newfoundland Railway have been tied up by ice and snow, recently, the airplane has been carrying mails and passengers from St. John's to various other towns. The machine has also been used to carry provisions to ships caught in the ice.

Buenos Aires-Montevideo Air Line.—A regular airplane passenger service between Buenos Aires and Montevideo has recently been started and hereafter two round trips will be made weekly, in addition to other air voyages of special urgency. On the first trip four passengers and a quantity of correspondence were transported.

Where to Fly

CALIFORNIA
SAN FRANCISCO, CALIFORNIA
EARL P. COOPER AIRPLANE & MOTOR CO.

ILLINOIS
CHECKERBOARD AIRPLANE SERVICE
FOREST PARK, ILLINOIS

INDIANA
One of the largest and best equipped flying fields in the United States.
CURTISS-INDIANA COMPANY
Kokomo, Indiana
ALL TYPES OF CURTISS PLANES.

MASSACHUSETTS
BOSTON AND SPRINGFIELD, MASS.
EASTERN AIRCRAFT CORP.
340 FIRST ST., BOSTON, MASS.

MINNESOTA
WHITE BEAR LAKE, MINN.
The Twin Cities' chief summer resort.
Harold G. Peterson Aircraft Company
SCHOOL OF AVIATION

NEW JERSEY NEW YORK AIR TERMINAL
800 Acres – 6 miles from Times Square.
Learn on ships that cannot tail spin. Planes rented $30. *hr.*
CHAMBERLIN AIRCRAFT
Hasbrouck Heights, N. J.

NEW YORK & NEW JERSEY
CURTISS FIELD, GARDEN CITY, LONG ISLAND
KENILWORTH FIELD, BUFFALO, N. Y.
FLYING STATION, ATLANTIC CITY, N. J.
CURTISS AEROPLANE & MOTOR CORPORATION

NEW YORK
AEROMARINE AIRWAYS, INC.
Times Building, New York
11 Passenger Flying Cruisers -- 5 passenger, open and enclosed Flying Boats. Sightseeing Tours - Flights to Shore and Lake Resorts

OHIO
DAYTON, OHIO.
Supplies, Hangars, Shops and Field 1 Mile from Dayton limits.
JOHNSON AIRPLANE & SUPPLY CO.

OREGON
LAND OR WATER FLYING
OREGON, WASHINGTON AND IDAHO AIRPLANE COMPANY
PORTLAND, OREGON

PENNSYLVANIA
Flying School and Commercial Aviation
Send for Circular
Official Flying field Aero Club of Pennsylvania
PHILADELPHIA AERO-SERVICE CORPORATION
636 Real Estate Trust Building, Philadelphia.

WISCONSIN
CURTISS-WISCONSIN AEROPLANE CO.
FLYING SCHOOL
Milwaukee Air Port
GILLES E. MEISENHEIMER
330 Clinton Street Milwaukee, Wis.

If you are one of the companies in your state having first class facilities for passenger carrying, pilots' training and special flights, you should be represented in WHERE TO FLY each week.

26 Consecutive Insertions $20.00